Mineral Resource Report 90
Part 1
1985

COAL RESOURCES OF BUTLER COUNTY, PENNSYLVANIA

PART 1. COAL CROP LINES, MINED-OUT AREAS, AND STRUCTURE CONTOURS

Compiled by
Clifford H. Dodge

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
OFFICE OF RESOURCES MANAGEMENT
BUREAU OF
TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, State Geologist

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Pennsylvania Geological Survey

PENNSYLVANIA GEOLOGICAL SURVEY

FOURTH SERIES

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1985

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CONTENTS

FIGURES

COAL RESOURCES OF BUTLER COUNTY, PENNSYLVANIA

PART 1. COAL CROP LINES, MINED-OUT AREAS, AND STRUCTURE CONTOURS

Compiled by
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INTRODUCTION

An important function of the Bureau of Topographic and Geologic Survey is to provide accurate, timely information on Pennsylvania's bituminous coal. To achieve this goal, the Bureau is working in cooperation with the U.S. Geological Survey to establish the National Coal Resources Data System (NCRDS). NCRDS is a computer data system developed by the U.S. Geological Survey to facilitate coal-resource calculations for the nation on a county-by-county and seam-by-seam basis, and to produce various kinds of tables and maps of coal characteristics.

Before NCRDS can be used for a particular bituminous-coal-producing county, all available data on the coal must be entered into the computer system. These data include site-specific (point-location) stratigraphic measurements and coal analyses, and specific map elements compiled on 7½-minute topographic quadrangle maps. The map elements, which include coal outcrop lines and mined-out areas, are digitized and stored in the system for subsequent computer manipulations.

Inasmuch as the maps showing coal outcrop lines and mined-out areas are in constant demand by the coal industry, consultants, planners, government personnel, and academicians, they are being made available in this publication. These maps will be of considerable help in planning exploration programs, land acquisition, land use planning, and environmental protection.

In Part 1 for Butler County, two kinds of coal maps may be included for each 7½-minute topographic quadrangle map (Figure 1). First, for each of the principal (principally mined) coal seams in a given quadrangle, there is a map showing (1) the coal outcrop (crop line) where the coal is present and its horizon where the coal is probably absent; and (2) the extent of all known strip and deep mining up to the time of compilation (1981–1984). Note that all coal areas on these maps are closed or bounded so that they can be used to calculate areas for coal-resource estimates. Second, for each quadrangle, there is a composite coal-crop map that includes the known extent of principal and minor coals, structure contours, and fold axes. Coal names in this report are commonly used in western Pennsylvania, except for the Strasburg coal, which is an Ohio term that refers to a coal found between the stratigraphic positions of the Lower and Middle Kittanning coals. In the glaciated areas of northwestern Butler County (see Figure 1), the shape of the coal crop lines reflects the underlying bedrock topography and not the surface topography. The maps contain information on sources of published and unpublished data, map reliability, map symbols, structure-contour intervals and datums, and names of fold axes. The general layout of the compilation maps is shown in Figure 2.

Map reliability terms for crop lines and structure contours are relative and somewhat subjective. Nevertheless, these terms can be quantified and are approximately as follows: very good, ±10 feet; and good, ±20 feet.

Other parts for Butler County will be published subsequently and will contain tabular information on the coal resources of the county and computer-generated thickness and quality maps of the principal coals. Where sufficient data are available, the quality maps will show trends for sulfur, heat value, ash content, fixed carbon, volatiles, major, minor, and trace elements, and other parameters for each principal coal.

A generalized reference list is given at the end of this section and contains those State and Federal publications that are most useful on the coal geology of Butler County.

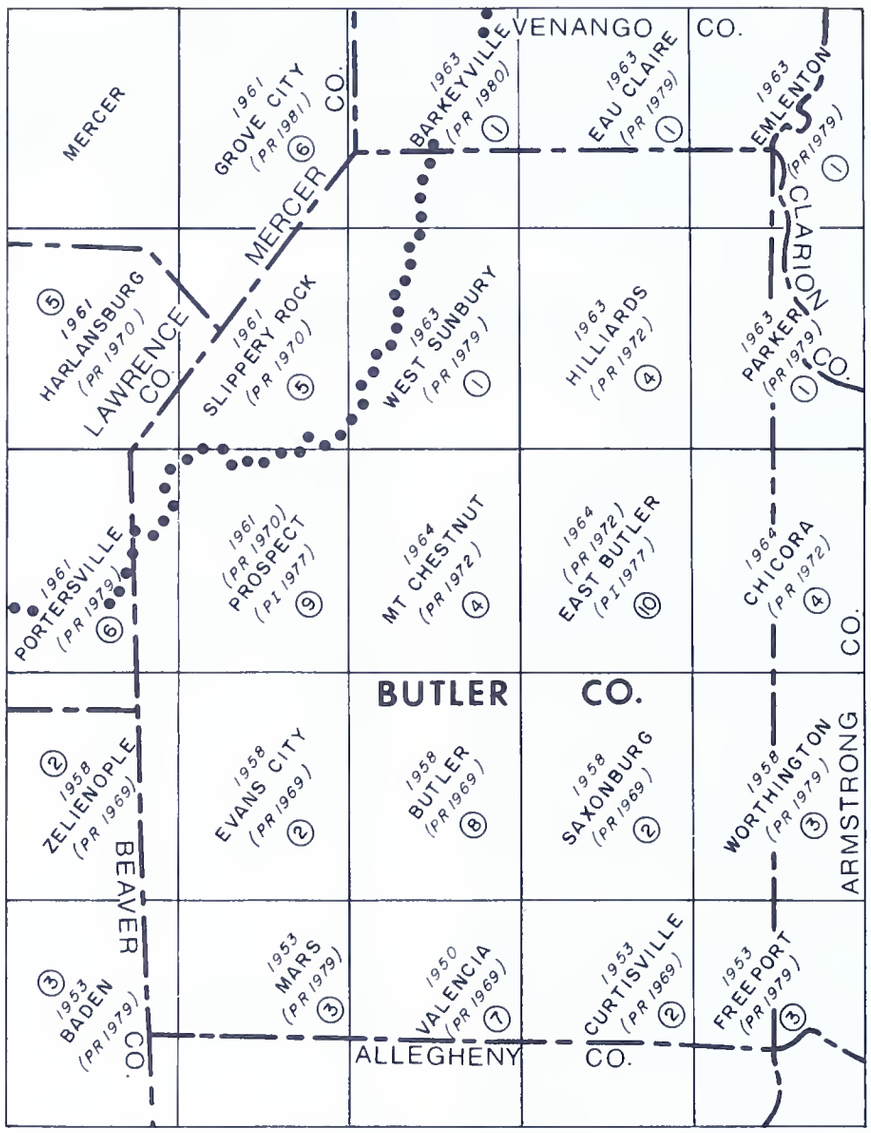

Figure 1. Index map of 7½-minute quadrangles in Butler County. Date of publication of topographic quadrangle map is shown in italic type. Dates of photorevision (PR) and photoinspection (PI) are shown in parentheses. Dotted line indicates terminal moraine.

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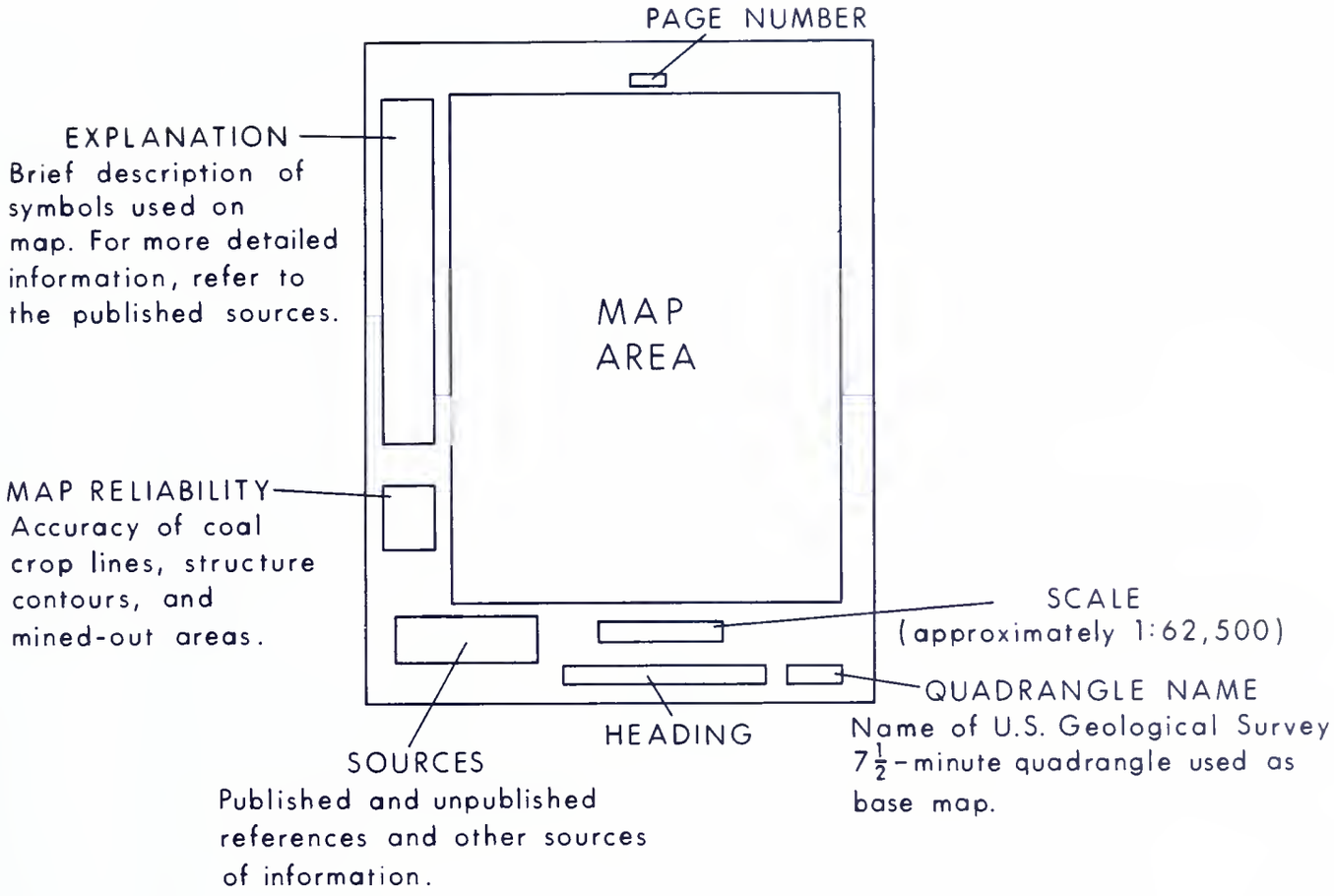

Figure 2. Guide to layout of compilation maps.

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EXPLANATION

Crop line of the Upper Freeport coal

Extent of known deep mining

MAP RELIABILITY

Coal crop line—very good

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Munn, M. J. (1911), *Sewickley folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 176, 16 p.

Limits of deep mining from Munn (1911).

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — State Route

QUADRANGLE LOCATION

BADEN

CROP LINE AND MINED-OUT AREA OF THE UPPER FREEPORT COAL

EXPLANATION

CROP LINES

wi — Wilgus coal

hc — Brush Creek coal

uf — Upper Freeport coal

Syncline
Showing axial-plane trace and direction of plunge.

900 — Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY

Coal crop lines—very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; and Munn, M. J. (1911), *Sewickley folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 176, 16 p.
Structure contours modified by C. H. Dodge from Munn (1911).

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

ROAD CLASSIFICATION
Heavy duty — Light duty
Medium duty — Unimproved dirt
Interstate Route — State Route

BADEN

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

BARKEYVILLE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Brookville coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from Gwin Engineers, Inc. (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 168 p.; and unpublished mine maps.

SCALE ≈1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy duty — Light duty
Medium duty — Unimproved dirt
Interstate Route — State Route

QUADRANGLE LOCATION

BARKEYVILLE

CROP LINE AND MINED-OUT AREAS OF THE BROOKVILLE COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — State Route

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking.

BARKEYVILLE

CROP LINE AND MINED-OUT AREAS OF THE LOWER KITTANNING COAL

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.

Limits of strip mining based on interpretation of topographic map and on field checking.

BARKEYVILLE

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—mk— Middle Kittanning coal

—lk— Lower Kittanning coal

—sg— Scrubgrass coal

—bk— Brookville coal

—1500— Structure contour
Altitude of the base of the Middle Kittanning coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Structure contours extensively modified by C. H. Dodge from Sherrill, R. E., and Matteson, L. S. (1939), *Geology of the oil and gas fields of the Hilliards quadrangle*, Pennsylvania Geological Survey, 4th ser., Progress Report 122, 25 p.

SCALE ≈1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1980 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy Duty — Medium Duty — Light Duty — Unimproved Dirt
Interstate Route — State Route

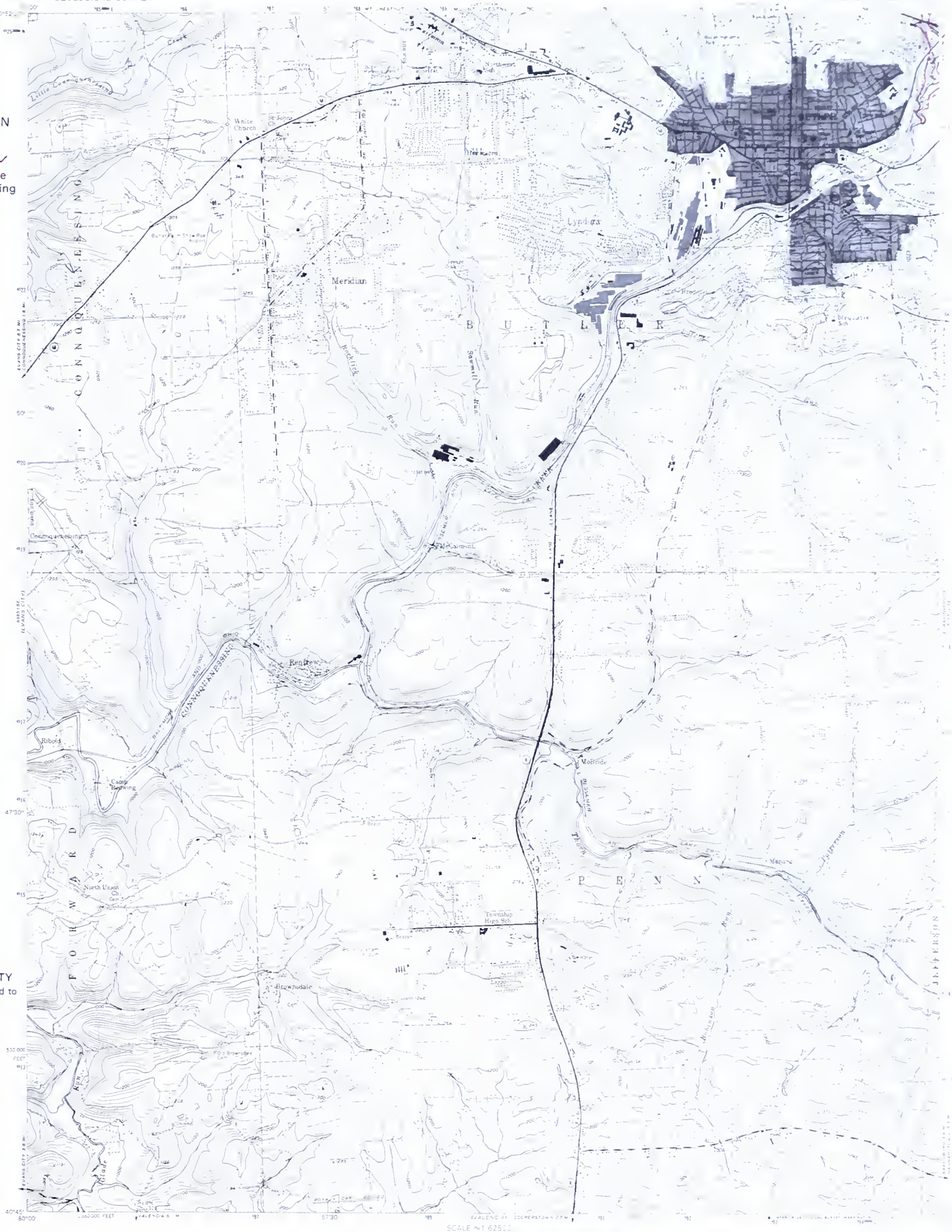
BARKEYVILLE

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Middle Kittanning coal



MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

SCALE ≈ 1:62500

CONTOUR INTERVAL 20 FEET
DATUM MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

BUTLER

CROP LINE OF THE

MIDDLE KITTANNING COAL

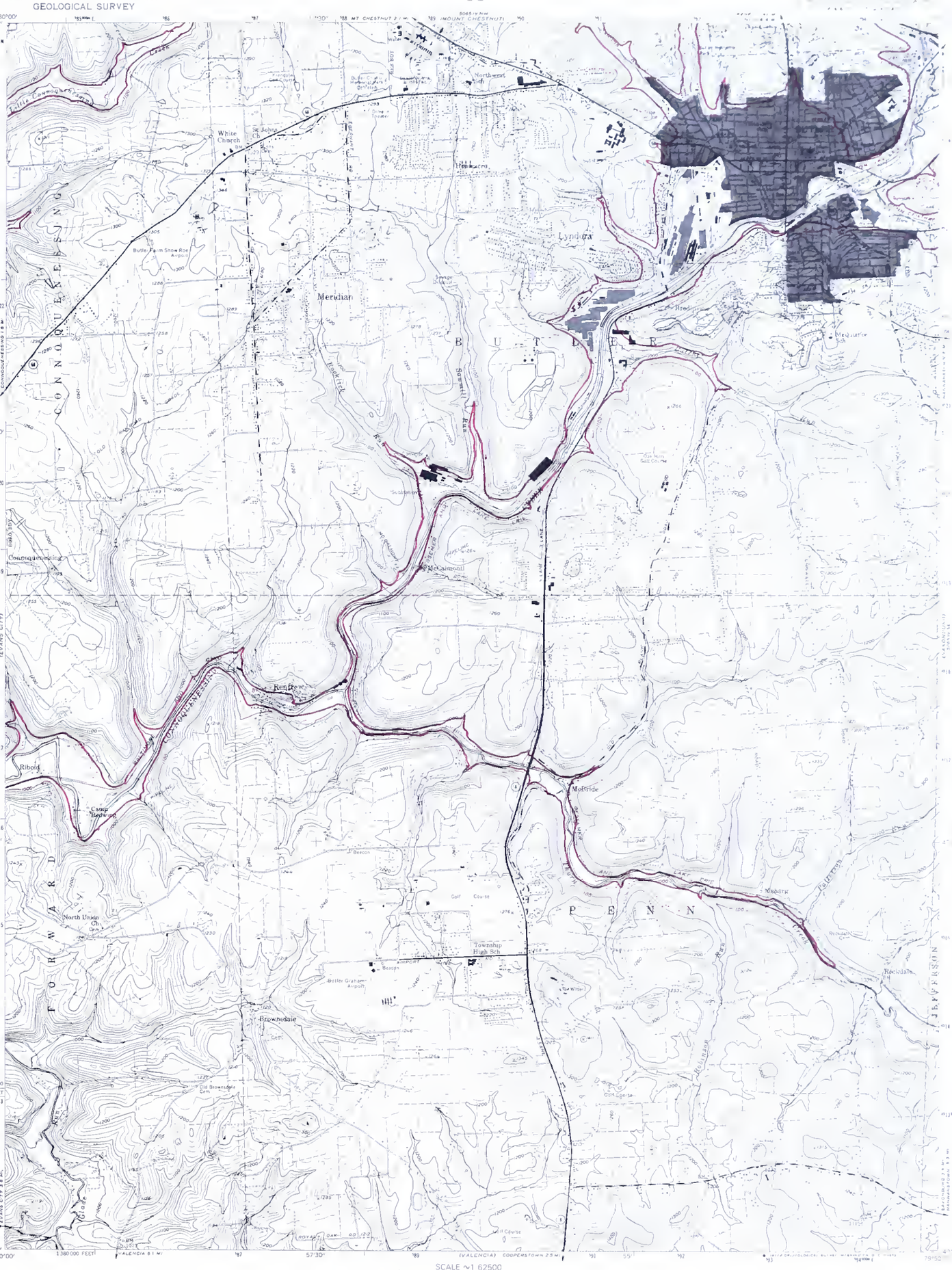
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the
Lower Freeport coal

MAP RELIABILITY

Coal crop line—good to very good



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Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

BUTLER

CROP LINE OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

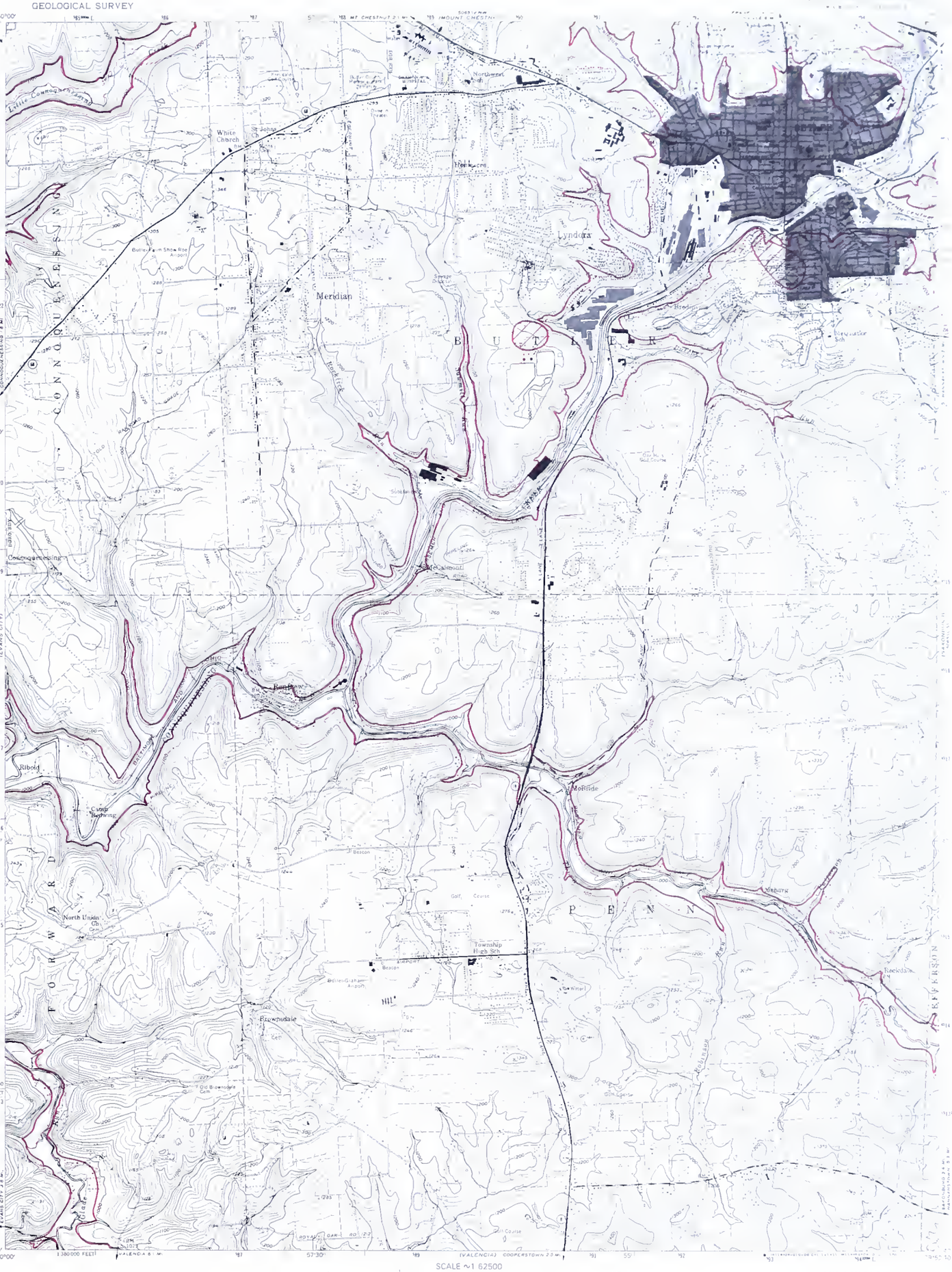
〰 Crop line of the Upper Freeport coal

▨ Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known deep mining—approximate



SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania,* U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania,* U.S. Geological Survey Bulletin 873, 93 p.

Limits of deep mining from Richardson (1936).

BUTLER

CROP LINE AND MINED-OUT AREAS OF THE
UPPER FREEPORT COAL

EXPLANATION

CROP LINES

du — Duquesne coal

ub — Upper Bakerstown coal

lb — Lower Bakerstown coal

wi — Wilgus coal

uf — Upper Freeport coal

lf — Lower Freeport coal

uk — Upper Kittanning coal

mk — Middle Kittanning coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge

1100 — Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Structure contours compiled by C. H. Dodge from unpublished data; some reference to Richardson (1936) and to Lytle, W. S., and Heeren, L. A., compilers (1955), *Oil and gas field atlas of the Butler quadrangle, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Special Bulletin 7, unpaginated.

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

BUTLER

COAL CROP LINES AND STRUCTURE CONTOURS

EXPLANATION

Crop line of the Middle Kittanning coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.

CHICORA

CROP LINE OF THE

MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CHICORA QUADRANGLE
PENNSYLVANIA
15 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Lower Freeport coal

▨ Extent of known strip mining

▨ Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania,* U.S. Geological Survey Bulletin 1143-C, p. C1-C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania,* U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from unpublished mine maps.

MN GN 6° 107 MILS 0°52' 15 MILS

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:62500

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

PENNSYLVANIA
QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy duty	▬	Light-duty	─
Medium duty	▬	Unimproved dirt	....

○ State Route

CHICORA

CROP LINE AND MINED-OUT AREAS OF THE
LOWER FREEPORT COAL

EXPLANATION

Crop line of the Upper Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from unpublished mine maps.

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
State Route

PENNSYLVANIA
QUADRANGLE LOCATION

CHICORA

CROP LINE AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL

EXPLANATION

CROP LINES

—— bc ——
Brush Creek coal

—— uf ——
Upper Freeport coal

—— lf ——
Lower Freeport coal

—— mk ——
Middle Kittanning coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge.

-1200-
Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.
Structure contours modified by C. H. Dodge from Rochester and Pittsburgh Coal Company (1977), unpublished map; minor reference to Butts and Leverett (1904).

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

COAL CROP LINES AND STRUCTURE CONTOURS

CHICORA

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Freeport coal

MAP RELIABILITY

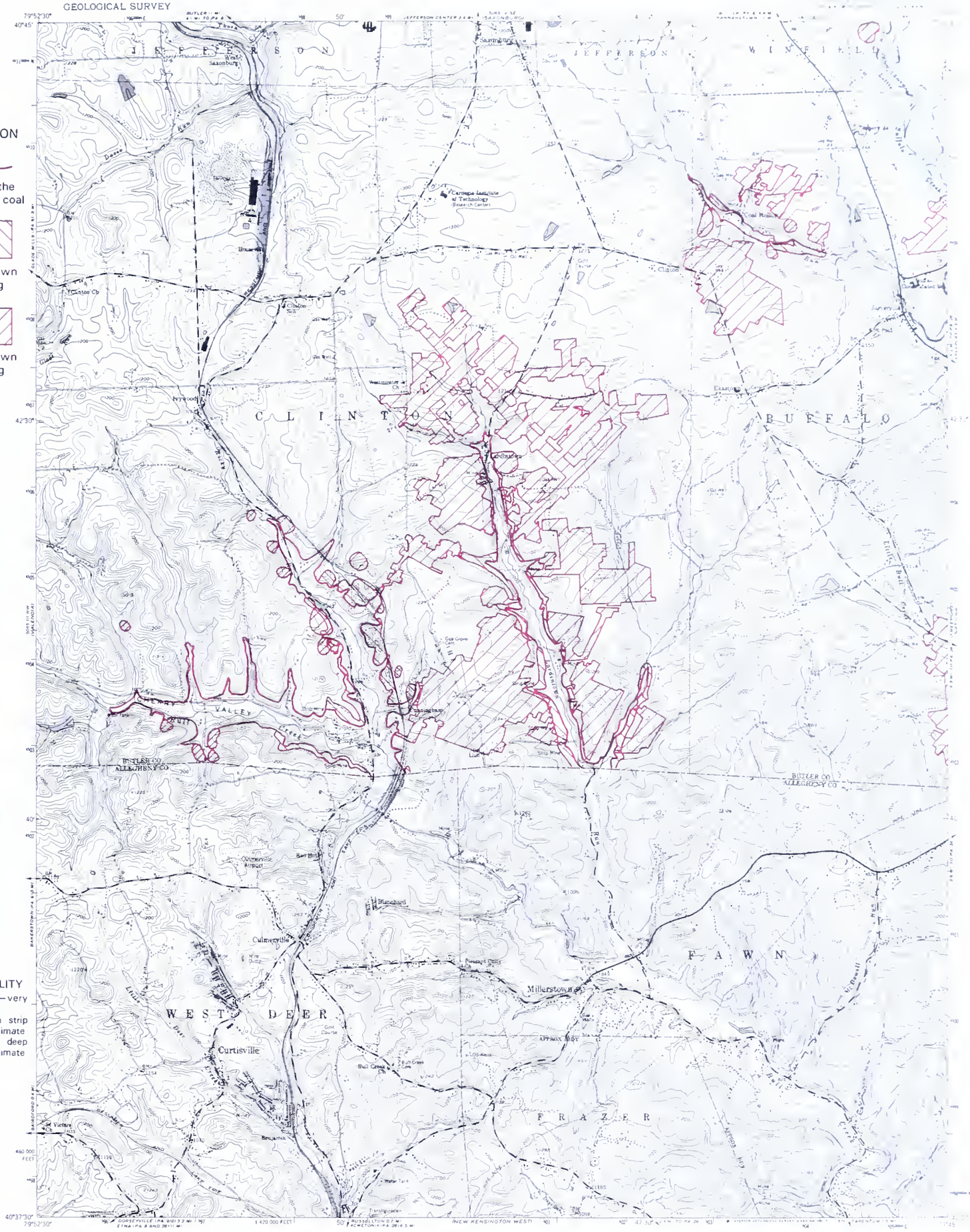
Coal crop line—very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43; minor reference to Richardson, G. B. (1932), *Geology and coal, oil, and gas resources of the New Kensington quadrangle, Pennsylvania*, U.S. Geological Survey Bulletin 829, 102 p.

CURTISVILLE

CROP LINE OF THE LOWER FREEPORT COAL



EXPLANATION

Crop line of the Upper Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1932), *Geology and coal, oil, and gas resources of the New Kensington quadrangle, Pennsylvania*, U.S. Geological Survey Bulletin 829, 102 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from John T. Boyd Company (1968), *Revised reserve alternatives—Case 1 and case 2, Hannahstown coal field, Butler County, Pennsylvania—For Bessemer and Lake Erie Railroad Company*, unpublished report, unpaginated; and unpublished mine maps.

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CROP LINE AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL

CURTISVILLE

EXPLANATION

CROP LINES

—uf—
Upper Freeport coal

—lf—
Lower Freeport coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge.

—1100—
Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY

Coal crop lines—very good
Structure contours—very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1932), *Geology and coal, oil, and gas resources of the New Kensington quadrangle, Pennsylvania*, U.S. Geological Survey Bulletin 829, 102 p.
Structure contours modified by C. H. Dodge from Zachar, F. R. (1963), *Upper Freeport coal seam—Connected reserves adjoining Bessemer and Lake Erie Railroad, southern Butler County, Pennsylvania*, unpublished report, 7 p.; some reference to Richardson (1932).

SCALE ~1:62500

COAL CROP LINES AND STRUCTURE CONTOURS

CURTISVILLE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Middle Kittanning coal

▨ Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known deep mining—approximate

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania,* U.S. Geological Survey Bulletin 1143-C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania,* U.S. Geological Survey Bulletin 873, 93 p.

Limits of deep mining from unpublished mine maps.

EAST BUTLER

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EAST BUTLER QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES

EXPLANATION

Crop line of the Lower Freeport coal

Horizon of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line and horizon—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

EAST BUTLER

CROP LINE, HORIZON, AND MINED-OUT AREAS OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Upper Freeport coal

Horizon of the Upper Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line and horizon—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from unpublished mine maps.

EAST BUTLER

CROP LINE, HORIZON, AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—bc— Brush Creek coal

—mh— Mahoning coal

—uf— Upper Freeport coal

—lf— Lower Freeport coal

—uk— Upper Kittanning coal

—mk— Middle Kittanning coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge

—1200— Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43, minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Structure contours compiled by C. H. Dodge from unpublished mine maps and unpublished data; some reference to Richardson (1936) and to Lytle, W. S., and Heeren, L. A., compilers (1955), *Oil and gas field atlas of the Butler quadrangle, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Special Bulletin 7, unpaginated.

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

EAST BUTLER

COAL CROP LINES AND STRUCTURE CONTOURS

EXPLANATION

Crop line of the Brookville coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from Gwin Engineers, Inc. (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 168 p.; and unpublished mine maps.

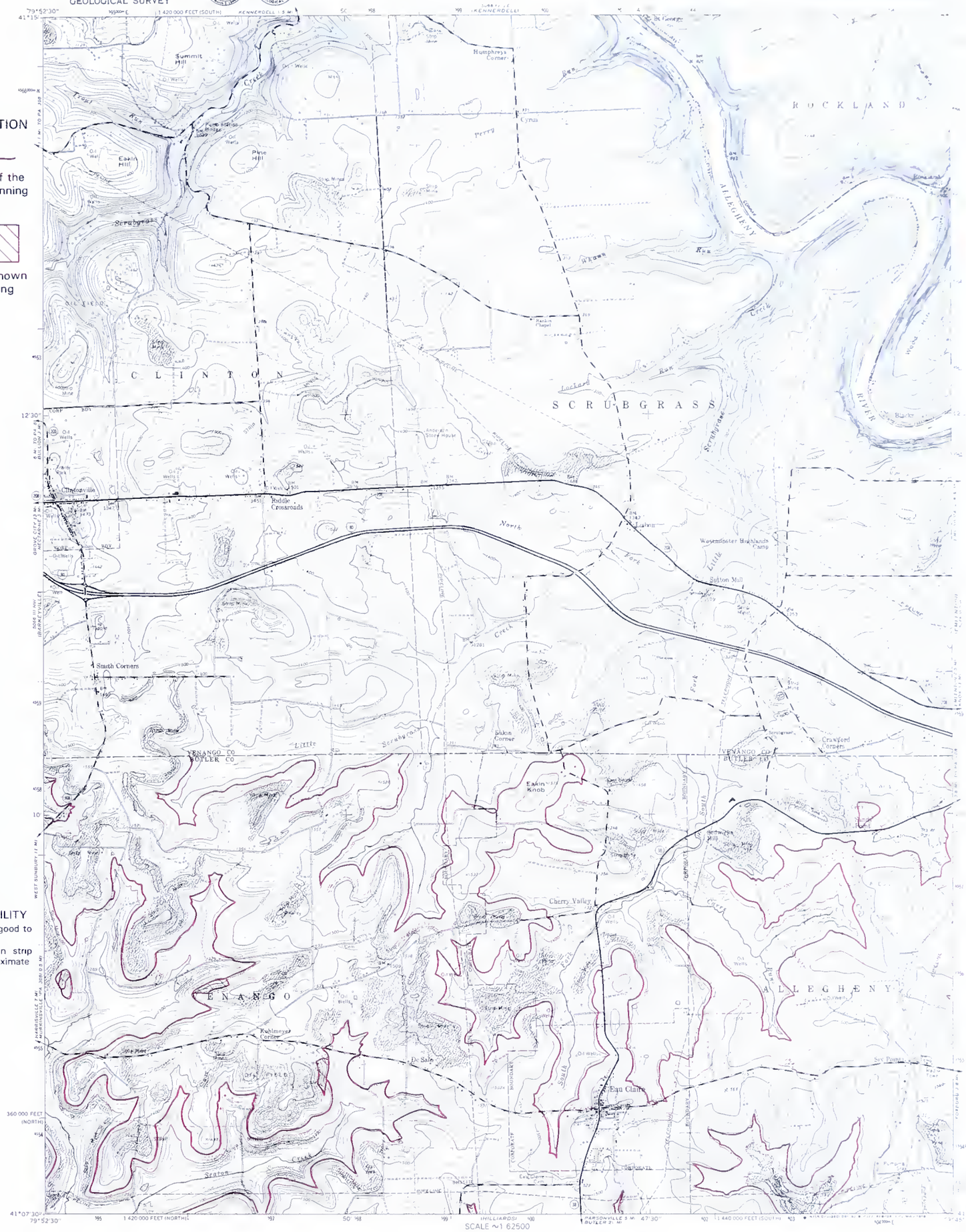
UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Heavy duty — Light duty
Medium duty — Unimproved dirt
Interstate Route — State Route

EAU CLAIRE

CROP LINE AND MINED-OUT AREAS OF THE BROOKVILLE COAL



EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking.

EAU CLAIRE

CROP LINE AND MINED-OUT AREAS OF THE LOWER KITTANNING COAL

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from Gwin Engineers (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 168 p.

EAU CLAIRE

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking.

EAU CLAIRE

CROP LINE AND MINED-OUT AREAS OF THE LOWER FREEPORT COAL

EXPLANATION

CROP LINES

—— lf ——
Lower Freeport coal

—— mk ——
Middle Kittanning coal

—— lk ——
Lower Kittanning coal

—— sg ——
Scrubgrass coal

—— bk ——
Brookville coal

Anticline
Showing axial-plane trace and direction of plunge

—1500—
Structure contour
Altitude of the base of the Middle Kittanning coal, in feet above mean sea level. Contour interval 20 feet

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Structure contours extensively modified by C. H. Dodge from Sherrill, R. E., and Matteson, L. S. (1939), *Geology of the oil and gas fields of the Hilliards quadrangle*, Pennsylvania Geological Survey, 4th ser., Progress Report 122, 25 p.

EAU CLAIRE

COAL CROP LINES AND STRUCTURE CONTOURS

EXPLANATION

Crop line of the Brookville coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Limits of strip mining based on interpretation of topographic map and on field checking

EMLENTON

CROP LINE AND MINED-OUT AREAS OF THE BROOKVILLE COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

NATIONAL GEODETIC VERTICAL DATUM OF 1929

EMLENTON

CROP LINE AND MINED-OUT AREAS OF THE

LOWER KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy duty — Primary
Medium duty — Unimproved
Interstate Route — State Route

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

EMLENTON

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Freeport coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

EMLENTON

CROP LINE OF THE LOWER FREEPORT COAL

EXPLANATION

CROP LINES

—lf— Lower Freeport coal

—mk— Middle Kittanning coal

—lk— Lower Kittanning coal

—sg— Scrubgrass coal

—bk— Brookville coal

Syncline
Showing axial-plane trace and direction of plunge.

—1300— Structure contour
Altitude of the base of the Brookville coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Structure contours modified by C. H. Dodge from Rochester and Pittsburgh Coal Company (1977), unpublished map; minor reference to Shaw and others (1911).

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE ≈1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Heavy Duty — Light Duty
Medium Duty — Unimproved
Interstate Route

COAL CROP LINES AND STRUCTURE CONTOURS

EMLENTON

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Extent of known strip mining

MAP RELIABILITY

Limits of known strip mining—approximate

SOURCE

Limits of strip mining based on interpretation of topographic map and on field checking.

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Heavy duty — Light duty
Medium duty — Unimproved dirt
U.S. Route — State Route
Interstate Route

EVANS CITY

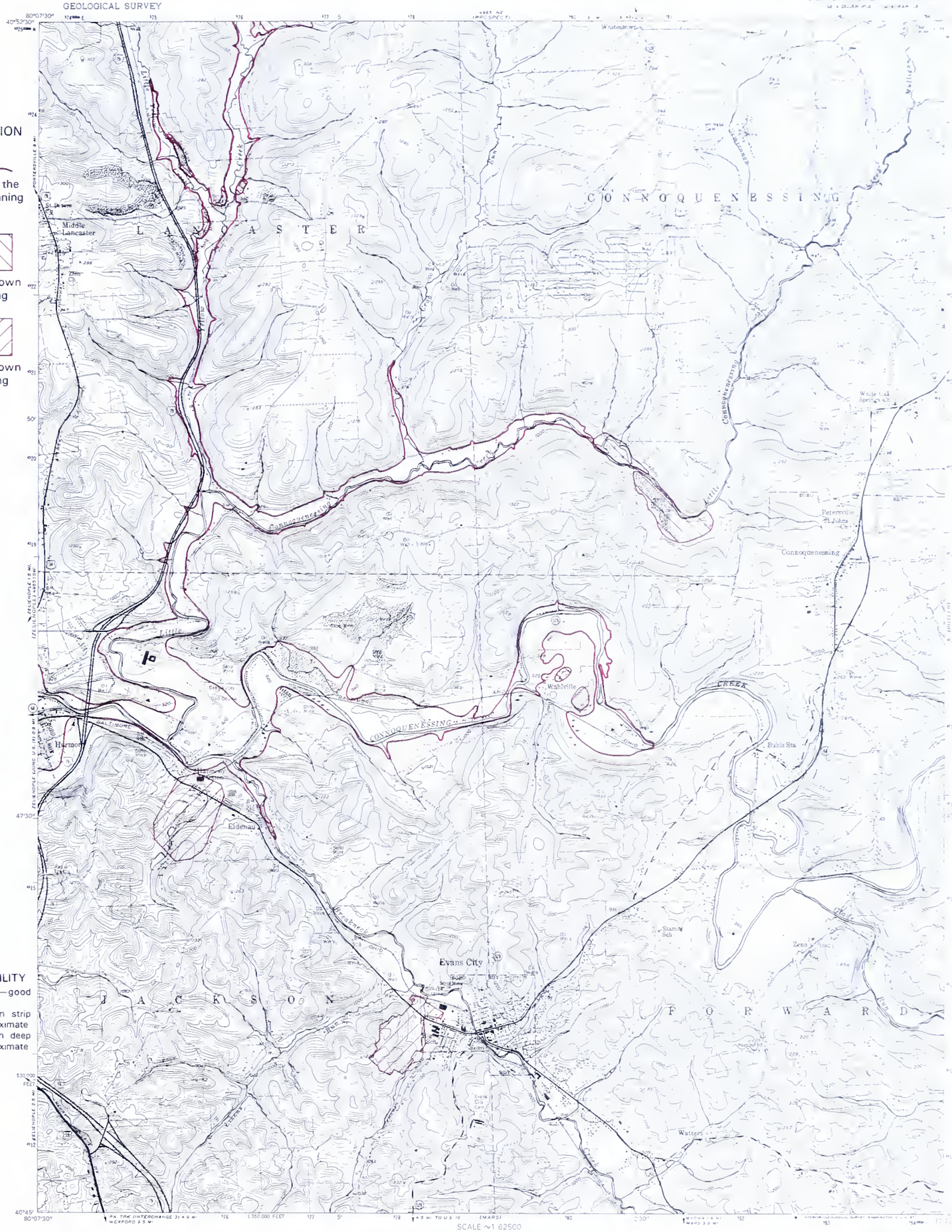
MINED-OUT AREAS OF THE

STRASBURG COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

- Crop line of the Middle Kittanning coal
- ▨ Extent of known strip mining
- ▨ Extent of known deep mining



MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line extensively modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from unpublished mine maps.

CROP LINE AND MINED-OUT AREAS OF THE
MIDDLE KITTANNING COAL

EVANS CITY

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Freeport coal

▨ Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate

SOURCES

Crop line extensively modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

CROP LINE AND MINED-OUT AREAS OF THE
LOWER FREEPORT COAL

EVANS CITY

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Upper Freeport coal

Horizon of the Upper Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line and horizon—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line extensively modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from unpublished mine maps.

EVANS CITY

CROP LINE, HORIZON, AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

— lb — Lower Bakerstown coal

— wi — Wilgus coal

— bc — Brush Creek coal

— mh — Mahoning coal

— uf — Upper Freeport coal

— lf — Lower Freeport coal

— uk — Upper Kittanning coal

— mk — Middle Kittanning coal

Syncline
Showing axial-plane trace and direction of plunge.

—1100— Structure contour
Showing altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines extensively modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Structure contours compiled by C. H. Dodge from unpublished data; some reference to Richardson (1936).

COAL CROP LINES AND STRUCTURE CONTOURS

EVANS CITY

EXPLANATION

Crop line of the
Middle Kittanning
coal

MAP RELIABILITY

Coal crop line—good
to very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Hughes, H. H. (1933), *Freeport quadrangle—Geology and mineral resources*, Pennsylvania Geological Survey, 4th ser., Atlas 36, 272 p.

FREEPORT

CROP LINE OF THE
MIDDLE KITTANNING COAL

EXPLANATION

Crop line of the Lower Freeport coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Hughes, H. H. (1933), *Freeport quadrangle—Geology and mineral resources*, Pennsylvania Geological Survey, 4th ser., Atlas 36, 272 p.

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

FREEPORT

CROP LINE OF THE
LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

〰 Crop line of the Upper Freeport coal

▨ Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known deep mining—approximate

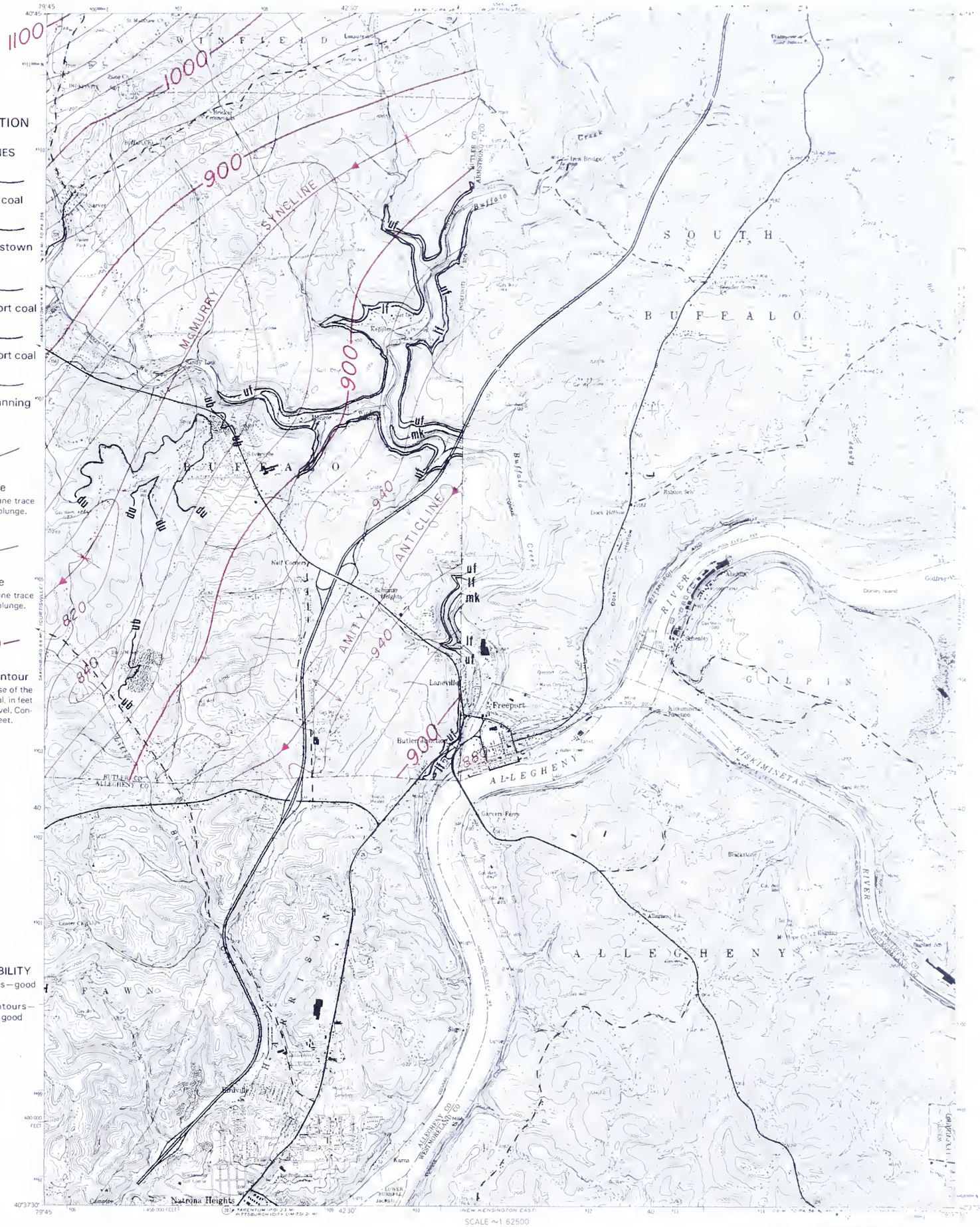
SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43, minor reference to Hughes, H. H. (1933), *Freeport quadrangle—Geology and mineral resources*, Pennsylvania Geological Survey, 4th ser., Atlas 36, 272 p.

Limits of deep mining from John T. Boyd Company (1968), *Revised reserve alternatives—Case 1 and case 2, Hannahstown coal field, Butler County, Pennsylvania—For Bessemer and Lake Erie Railroad Company*, unpublished report, unpaginated; and unpublished mine maps.

FREEPORT

CROP LINE AND MINED-OUT AREAS OF THE
UPPER FREEPORT COAL



EXPLANATION

CROP LINES

—— du ——
Duquesne coal

—— ub ——
Upper Bakerstown coal

—— uf ——
Upper Freeport coal

—— lf ——
Lower Freeport coal

—— mk ——
Middle Kittanning coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge.

—900—
Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; minor reference to Hughes, H. H. (1933), *Freeport quadrangle—Geology and mineral resources*, Pennsylvania Geological Survey, 4th ser., Atlas 36, 272 p.
Structure contours compiled by C. H. Dodge from unpublished mine maps and unpublished data; some reference to Hughes (1933).

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

COAL CROP LINES AND STRUCTURE CONTOURS

FREEPORT

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Brookville coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania,* Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania,* U.S. Geological Survey Bulletin 1143–C, p. C1–C43.

UTM GRID AND 1981 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

GROVE CITY

CROP LINE OF THE BROOKVILLE COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

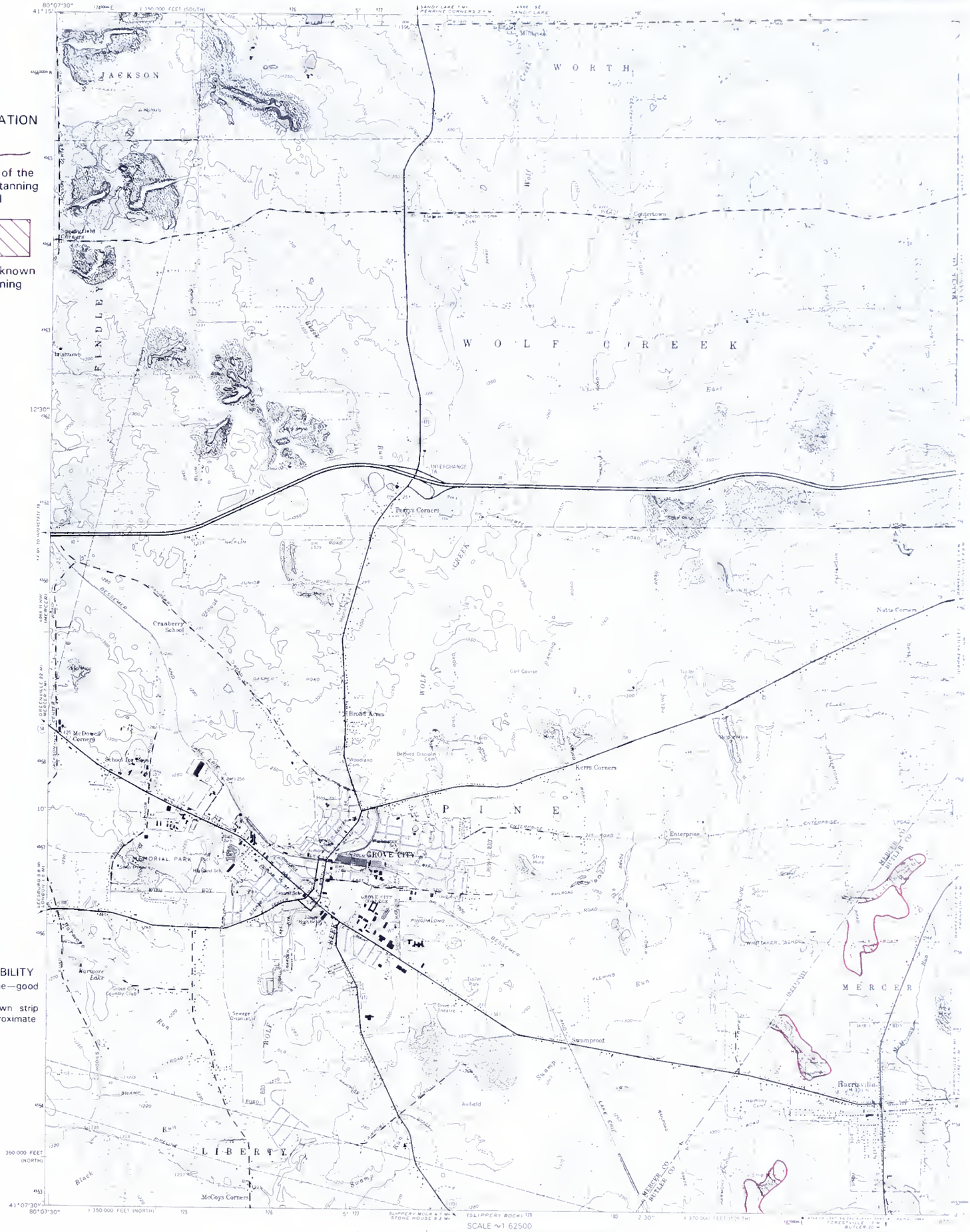
SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43. Limits of strip mining based on interpretation of topographic map and on field checking.

GROVE CITY

CROP LINE AND MINED-OUT AREA OF THE LOWER KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43. Limits of strip mining based on interpretation of topographic map and on field checking.

GROVE CITY

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—mk—
Middle Kittanning coal

—lk—
Lower Kittanning coal

—bk—
Brookville coal

—1260—
Structure contour
Altitude of the base of the Brookville coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43. Structure contours extensively modified by C. H. Dodge from Poth (1963).

GROVE CITY

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HARLANSBURG QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Brookville coal

MAP RELIABILITY

Coal crop line—good to very good

SCALE ≈1:62500

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy duty — Light duty
Medium duty — Unimproved dirt
Interstate Route — U.S. Route — State Route

QUADRANGLE LOCATION

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43.

HARLANSBURG

CROP LINE OF THE BROOKVILLE COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43. Limits of strip mining based on interpretation of topographic map and on field checking.

HARLANSBURG

CROP LINE AND MINED-OUT AREAS OF THE

LOWER KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43.

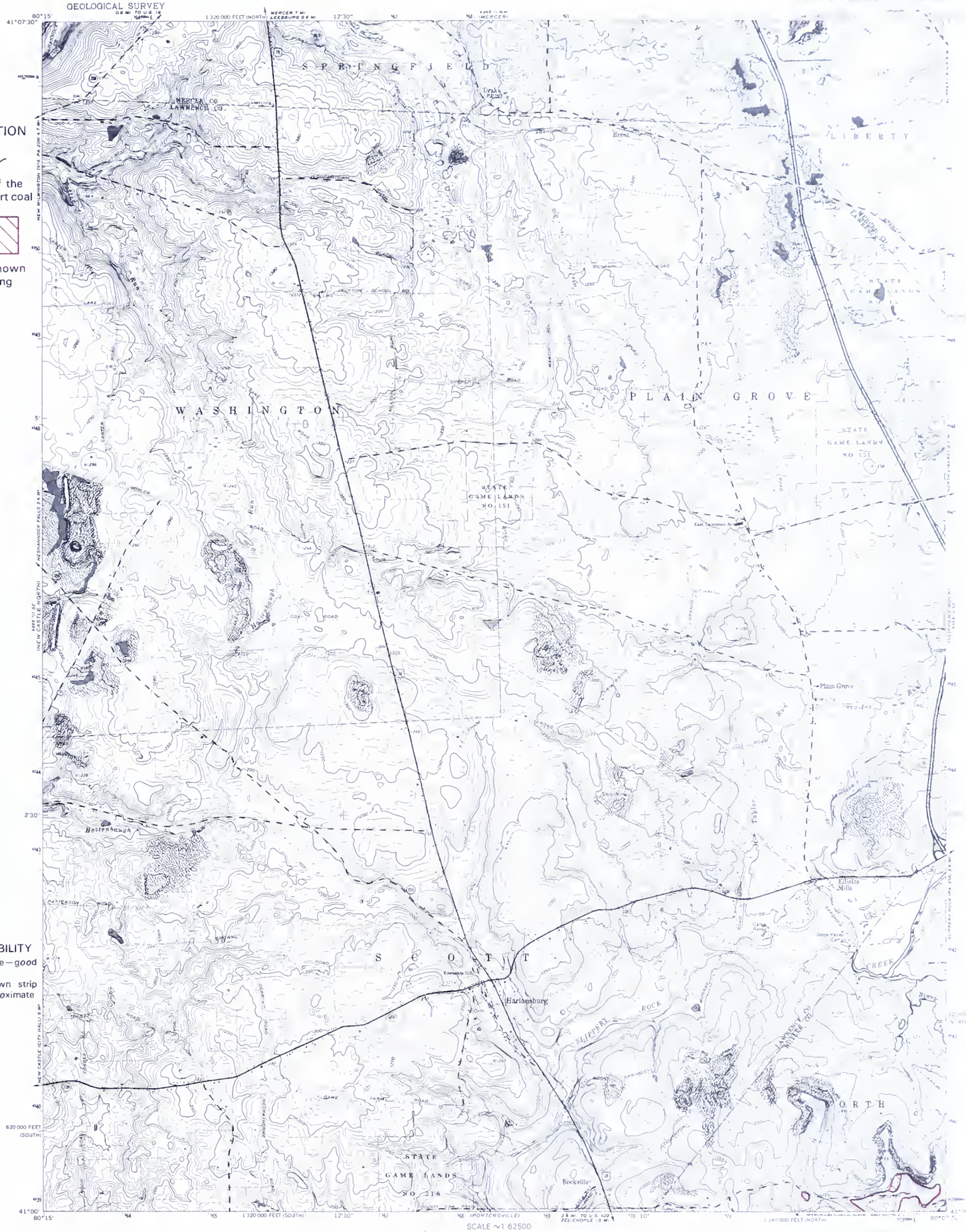
Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from Gwin Engineers, Inc. (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 168 p.

HARLANSBURG

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43. Limits of strip mining based on interpretation of topographic map and on field checking.

HARLANSBURG

CROP LINE AND MINED-OUT AREA OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HARLANSBURG QUADRANGLE
PENNSYLVANIA
15 MINUTE SERIES

EXPLANATION

Horizon of the Upper Freeport coal

MAP RELIABILITY

Coal horizon—good to very good

SCALE ~1:62500

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

SOURCES

Coal horizon based on interval projection from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43.

HARLANSBURG

HORIZON OF THE UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—lf— Lower Freeport coal

—uk— Upper Kittanning coal

—mk— Middle Kittanning coal

—lk— Lower Kittanning coal

—bk— Brookville coal

Anticline
Showing axial-plane trace and direction of plunge.

—1140— **Structure contour**
Altitude of the base of the Brookville coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43. Structure contours extensively modified by C. H. Dodge from Poth (1963).

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

HARLANSBURG

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HILLIARDS QUADRANGLE
PENNSYLVANIA-BUTLER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Brookville coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from Gwin Engineers, Inc. (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 168 p.; and unpublished mine maps.

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

HILLIARDS

CROP LINE AND MINED-OUT AREAS OF THE BROOKVILLE COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking.

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

HILLIARDS

CROP LINE AND MINED-OUT AREAS OF THE LOWER KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HILLIARDS QUADRANGLE
PENNSYLVANIA—BUTLER
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

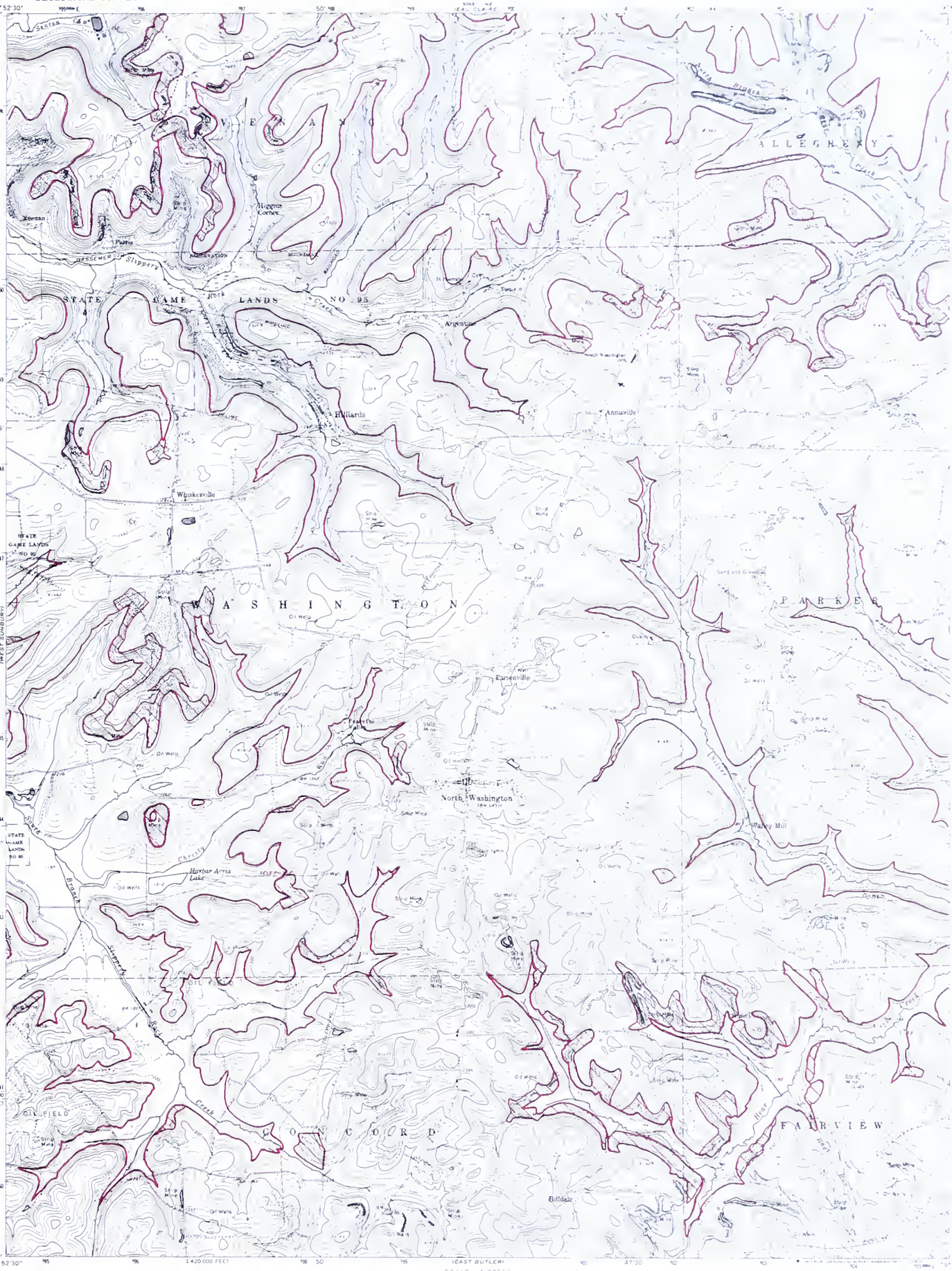
Crop line of the Middle Kittanning coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate



SOURCES

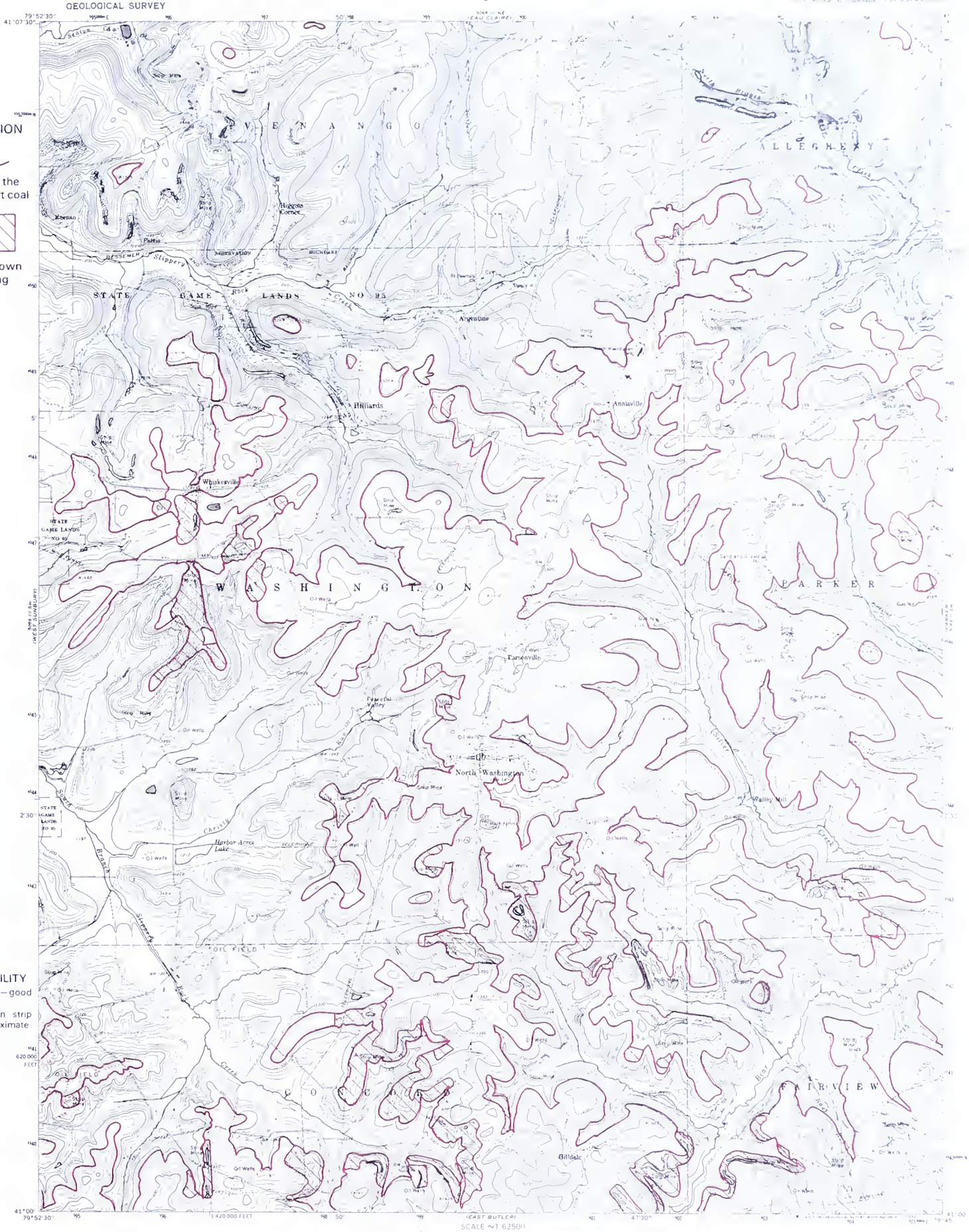
Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from unpublished mine maps.

HILLIARDS

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

HILLIARDS QUADRANGLE
PENNSYLVANIA-BUTLER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)



EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate

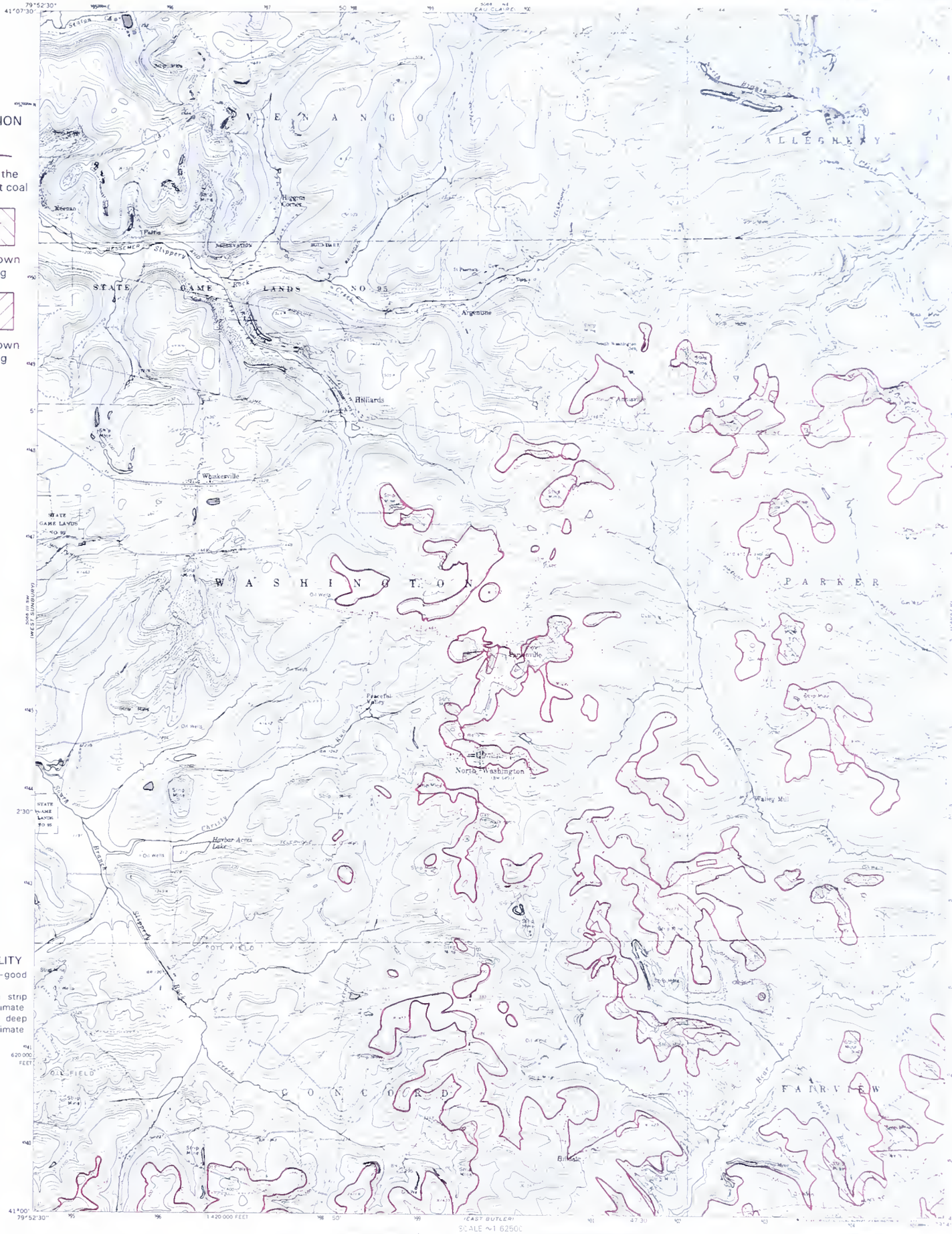
SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43.
Limits of strip mining based on interpretation of topographic map and on field checking.

HILLIARDS

CROP LINE AND MINED-OUT AREAS OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



EXPLANATION

Crop line of the Upper Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from unpublished mine maps.

HILLIARDS

CROP LINE AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—uf— Upper Freeport coal

—lf— Lower Freeport coal

—uk— Upper Kittanning coal

—mk— Middle Kittanning coal

—lk— Lower Kittanning coal

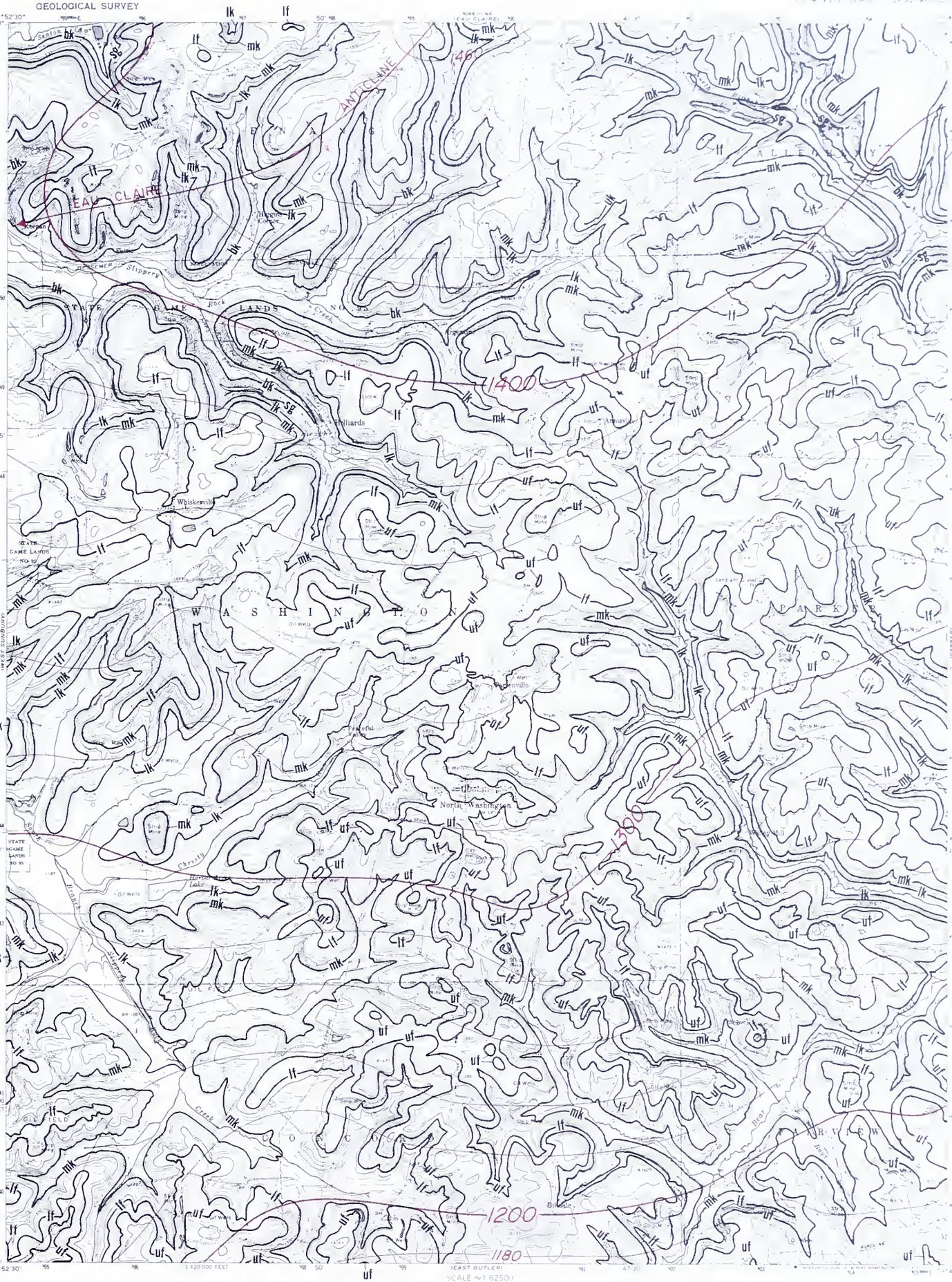
—sg— Scrubgrass coal

—bk— Brookville coal

Anticline
Showing axial-plane trace and direction of plunge.

—1400— Structure contour
Altitude of the base of the Middle Kittanning coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good



SCALE 1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
Heavy duty — Light duty
Medium duty — Unimproved dirt
State Route

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.
Structure contours extensively modified by C. H. Dodge from Sherrill, R. E., and Matteson, L. S. (1939), *Geology of the oil and gas fields of the Hilliards quadrangle*, Pennsylvania Geological Survey, 4th ser., Progress Report 122, 25 p.

HILLIARDS

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Freeport coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Munn, M. J. (1911), *Sewickley folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 176, 16 p.

JTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

MARS

CROP LINE OF THE

LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Upper Freeport coal

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Munn, M. J. (1911), *Sewickley folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 176, 16 p.
Limits of deep mining from Munn (1911).

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

MARS

CROP LINE AND MINED-OUT AREA OF THE

UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—we— Wellersburg coal

—du— Duquesne coal

—hm— Harlem coal

—ub— Upper Bakerstown coal

—wi— Wilgus coal

—bc— Brush Creek coal

—mh— Mahoning coal

—uf— Upper Freeport coal

—lf— Lower Freeport coal

Anticline
Showing axial-plane trace and direction of plunge

Syncline
Showing axial-plane trace and direction of plunge.

—900— Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43; and Munn, M. J. (1911), *Sewickley folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 176, 16 p.
Structure contours modified by C. H. Dodge from Munn (1911).

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

MARS

COAL CROP LINES AND STRUCTURE CONTOURS

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from unpublished mine maps.

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

MOUNT CHESTNUT

EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

CROP LINE AND MINED-OUT AREAS OF THE

LOWER FREEPORT COAL

MOUNT CHESTNUT

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Upper Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking

Limits of deep mining from unpublished mine maps.

CROP LINE AND MINED-OUT AREAS OF THE

UPPER FREEPORT COAL

MOUNT CHESTNUT

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

bc — Brush Creek coal

mh — Mahoning coal

uf — Upper Freeport coal

lf — Lower Freeport coal

uk — Upper Kittanning coal

mk — Middle Kittanning coal

Syncline
Showing axial-plane trace and direction of plunge.

-1300-
Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43. Minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.; and Gwin Engineers, Inc. (1968), *Report of mine drainage project MD-8A for Commonwealth of Pennsylvania, Department of Mines & Mineral Industries—Moraine State Park watershed area, Butler County, Pennsylvania* Department of Mines and Mineral Industries, Mine Drainage Project MD-8A, 109 p.

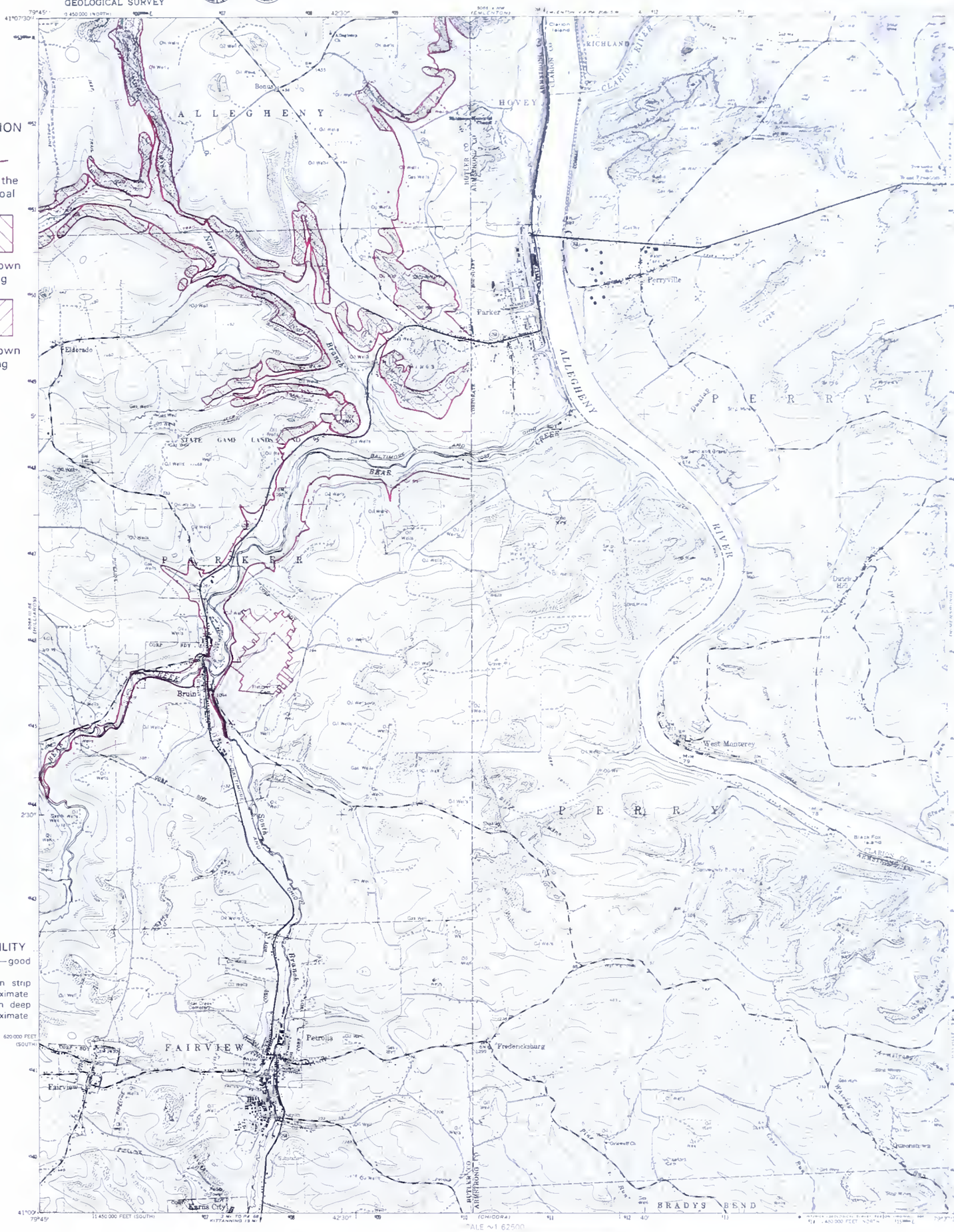
Structure contours compiled by C. H. Dodge from unpublished mine maps and unpublished data. Some reference to Richardson (1936) and to Lytle, W. S., and Heeren, L. A., compilers (1955), *Oil and gas field atlas of the Butler quadrangle, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Special Bulletin 7, unpaginated.

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1972 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

COAL CROP LINES AND STRUCTURE CONTOURS

MOUNT CHESTNUT



EXPLANATION

Crop line of the Brookville coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Limits of strip mining based on interpretation of topographic map and on field checking

Limits of deep mining from unpublished mine maps

UTM GRID AND 1973 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

State Route

PARKER

CROP LINE AND MINED-OUT AREAS OF THE BROOKVILLE COAL

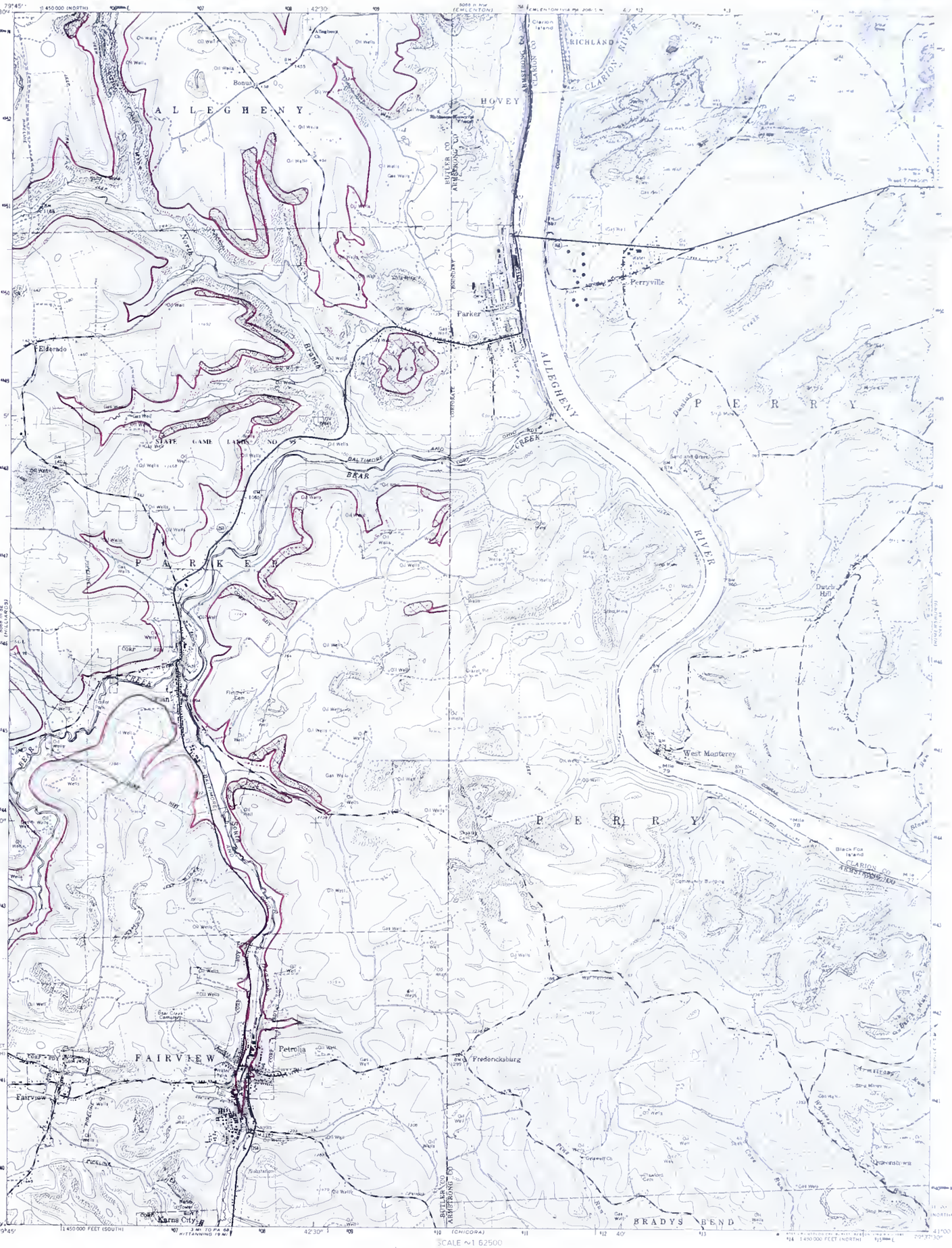
UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PARKER QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

〰 Crop line of the Lower Kittanning coal

▨ Extent of known strip mining



MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

PARKER

CROP LINE AND MINED-OUT AREAS OF THE
LOWER KITTANNING COAL

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
1 State Route

PARKER

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

PARKER

CROP LINE AND MINED-OUT AREAS OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Upper Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

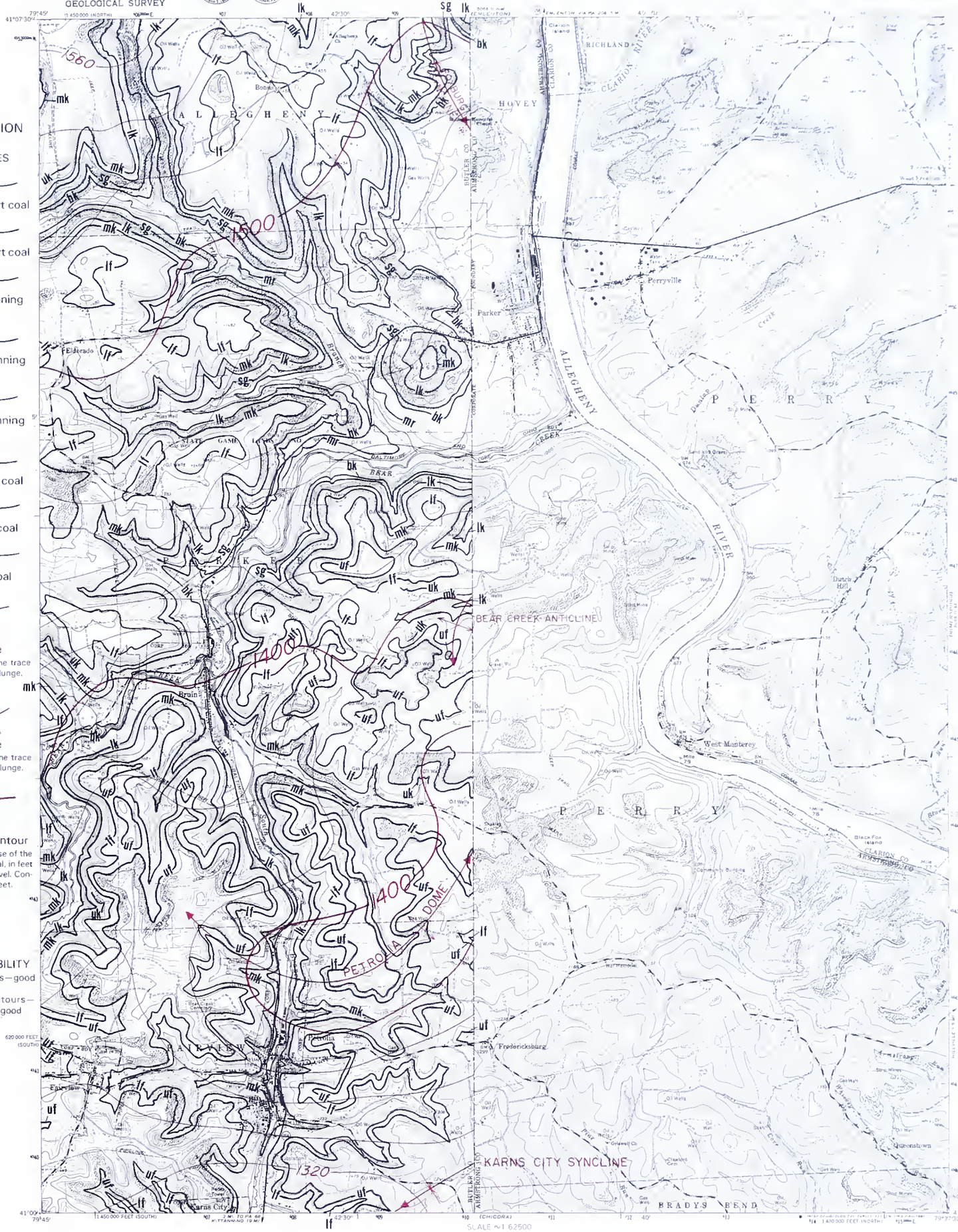
Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from unpublished mine maps.

PARKER

CROP LINE AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL



EXPLANATION

CROP LINES

- uf — Upper Freeport coal
- lf — Lower Freeport coal
- uk — Upper Kittanning coal
- mk — Middle Kittanning coal
- lk — Lower Kittanning coal
- sg — Scrubgrass coal
- bk — Brookville coal
- mr — Mercer coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge.

—1400—
Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; and Rochester and Pittsburgh Coal Company (1977), unpublished map. Minor reference to Shaw, E. W., Lines, E. F., and Munn, M. J. (1911), *Foxburg-Clarion folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 178, 18 p.
Structure contours modified by C. H. Dodge from Rochester and Pittsburgh Coal Company (1977), unpublished map; minor reference to Shaw and others (1911).

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
State Route

QUADRANGLE LOCATION

PARKER

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PORTERSVILLE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Brookville coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:62 500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

PORTERSVILLE

CROP LINE OF THE

BROOKVILLE COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PORTERSVILLE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin B73, 93 p.
Limits of strip mining based on interpretation of topographic map and on field checking.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Heavy-duty — Unimproved dirt
Medium-duty — Interstate
U.S. Route — State Route

PORTERSVILLE

CROP LINE AND MINED-OUT AREAS OF THE LOWER KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PORTERSVILLE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from Gwin Engineers, Inc. (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 168 p.; and unpublished mine maps.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

PORTERSVILLE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PORTERSVILLE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43, some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Limits of strip mining based on interpretation of topographic map and on field checking.
Limits of deep mining from unpublished mine maps.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

PENNSYLVANIA
QUADRANGLE LOCATION

PORTERSVILLE

CROP LINE AND MINED-OUT AREAS OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PORTERSVILLE QUADRANGLE
PENNSYLVANIA
MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Upper Freeport coal

Horizon of the Upper Freeport coal

MAP RELIABILITY

Coal crop line and horizon—good to very good

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy-duty
Light-duty
Medium-duty
Unimproved dirt
U.S. Route
State Route
Interstate Route

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*. U.S. Geological Survey Bulletin 1143-C, p. C1-C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

PORTERSVILLE

CROP LINE AND HORIZON OF THE

UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PORTERSVILLE QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

CROP LINES

—mh— Mahoning coal

—uf— Upper Freeport coal

—lf— Lower Freeport coal

—uk— Upper Kittanning coal

—mk— Middle Kittanning coal

—lk— Lower Kittanning coal

—bk— Brookville coal

Anticline
Showing axial-plane trace and direction of plunge.

—1100— Structure contour
Altitude of the base of the Middle Kittanning coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Structure contours compiled by C. H. Dodge from unpublished data; some reference to Richardson (1936); minor reference to Gwin Engineers, Inc. (1968), *Report of mine drainage project MD-8A for Commonwealth of Pennsylvania, Department of Mines & Mineral Industries—Moraine State Park watershed area, Butler County*, Pennsylvania Department of Mines and Mineral Industries, Mine Drainage Project MD-8A, 109 p.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route
Interstate Route

QUADRANGLE LOCATION

PORTERSVILLE

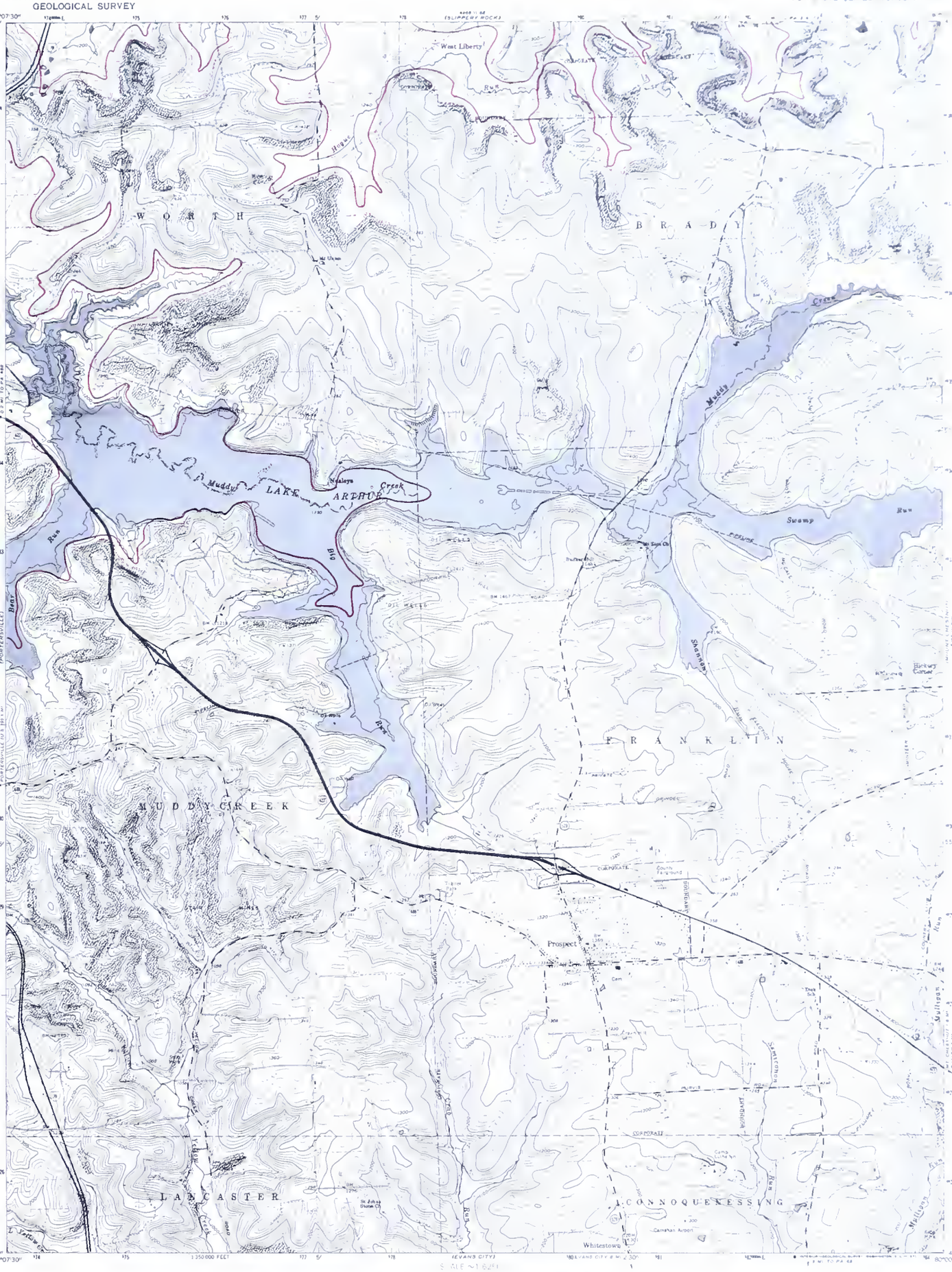
COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PROSPECT QUADRANGLE
PENNSYLVANIA—BUTLER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Lower Kittanning coal



MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route
Interstate Route

QUADRANGLE LOCATION

PROSPECT

CROP LINE OF THE LOWER KITTANNING COAL

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking

Limits of deep mining from Gwin Engineers, Inc. (1968), *Report of mine drainage project MD-8A for Commonwealth of Pennsylvania, Department of Mines & Mineral Industries—Moraine State Park watershed area, Butler County*, Pennsylvania Department of Mines and Mineral Industries, Mine Drainage Project MD-8A, 109 p.; Green Engineering Company (1974), *Mine drainage abatement survey, Yellow Creek watershed, Butler County, Pennsylvania*, Pennsylvania Department of Environmental Resources, Operation Scarlift Project SL 158, 31 p.; and unpublished mine maps.

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE ≈1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route
Interstate Route

PROSPECT

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PROSPECT 7½' QUADRANGLE
PENNSYLVANIA—BUTLER
15 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY
Coal crop line—good to very good
Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Limits of strip mining based on interpretation of topographic map and on field checking.

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
Heavy-duty — Interstate
Medium-duty — Unimproved dirt
U. S. Route — State Route

QUADRANGLE LOCATION

PROSPECT

CROP LINE AND MINED-OUT AREAS OF THE
LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

PROSPECT QUADRANGLE
PENNSYLVANIA BUTLER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Upper Freeport coal

Horizon of the Upper Freeport coal

▧ Extent of known strip mining

▨ Extent of known deep mining

MAP RELIABILITY

Coal crop line and horizon—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania,* U.S. Geological Survey Bulletin 1143-C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania,* U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from unpublished mine maps.

PROSPECT

CROP LINE, HORIZON, AND MINED-OUT AREAS OF THE
UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—— lb ——
Lower Bakerstown coal

—— bc ——
Brush Creek coal

—— mh ——
Mahoning coal

—— uf ——
Upper Freeport coal

—— lf ——
Lower Freeport coal

—— uk ——
Upper Kittanning coal

—— mk ——
Middle Kittanning coal

—— lk ——
Lower Kittanning coal

—1300—
Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

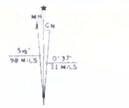
MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania,* U.S. Geological Survey Bulletin 1143-C, p. C1-C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania,* U.S. Geological Survey Bulletin 873, 93 p.

Structure contours compiled by C. H. Dodge from unpublished data, some reference to Richardson (1936); minor reference to Gwin Engineers, Inc. (1968), *Report of mine drainage project MD 8A for Commonwealth of Pennsylvania, Department of Mines & Mineral Industries—Moraine State Park watershed area, Butler County,* Pennsylvania Department of Mines and Mineral Industries, Mine Drainage Project MD-8A, 109 p.



UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy duty	——	Light-duty	——
Medium-duty	——	Unimproved dirt	....

U.S. Route   State Route
Interstate Route

PENNSYLVANIA
QUADRANGLE LOCATION

PROSPECT

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Middle Kittanning coal

▨ Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43, minor reference to Richardson, G. B (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of deep mining from unpublished mine maps.

SAXONBURG

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

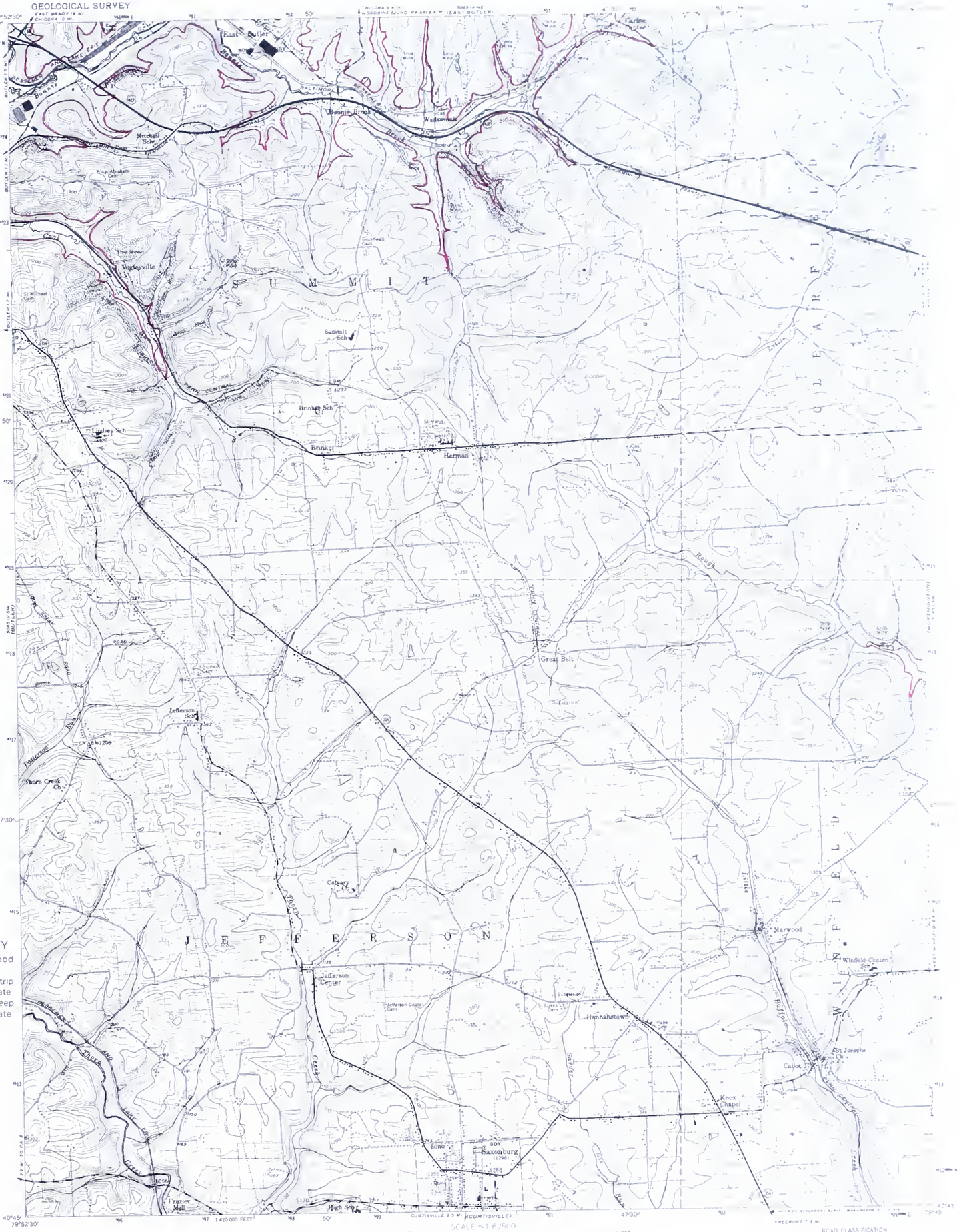
Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate



SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania* U.S. Geological Survey Bulletin 1143-C, p. C1-C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from unpublished mine maps.

SAXONBURG

CROP LINE AND MINED-OUT AREAS OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Upper Freeport coal

▨ Extent of known strip mining

▨ Extent of known deep mining

MAP RELIABILITY
Coal crop line—good to very good
Limits of known strip mining—approximate
Limits of known deep mining—approximate

SCALE 1:62,500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy duty
Light duty
Medium duty
Unimproved dirt
U S Route
State Route

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

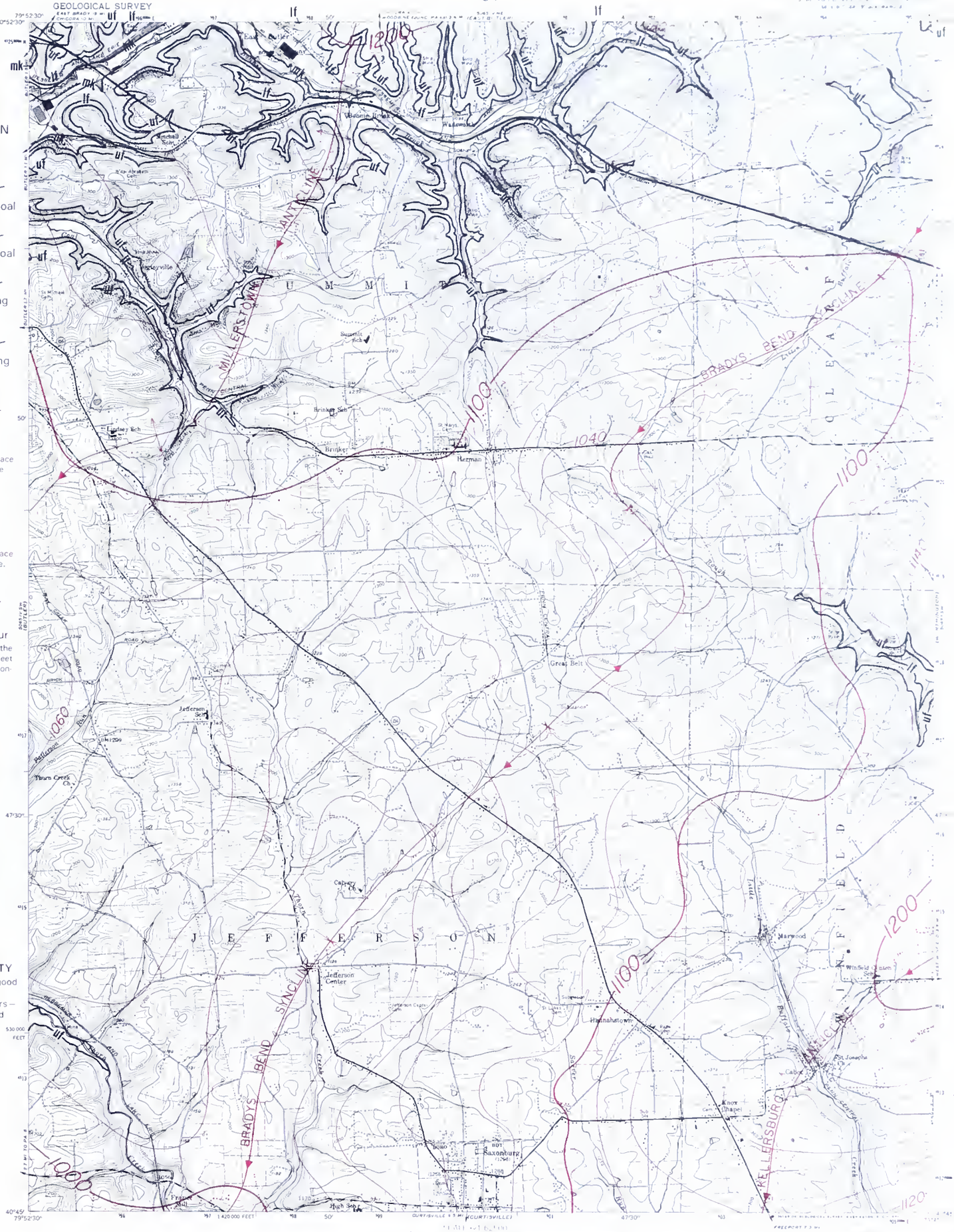
Limits of deep mining from John T. Boyd Company (1968), *Revised reserve alternatives—Case 1 and case 2, Hannahstown coal field, Butler County, Pennsylvania—For Bessemer and Lake Erie Railroad Company*, unpublished report, unpaginated, and unpublished mine maps.

CROP LINE AND MINED-OUT AREAS OF THE

UPPER FREEPORT COAL

SAXONBURG

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



EXPLANATION

CROP LINES

—uf— Upper Freeport coal

—lf— Lower Freeport coal

—uk— Upper Kittanning coal

—mk— Middle Kittanning coal

Anticline
Showing axial-plane trace and direction of plunge

Syncline
Showing axial-plane trace and direction of plunge.

—1100— Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Structure contours compiled by C. H. Dodge from unpublished data; some reference to Richardson (1936) and to Lytle, W. S., and Heeren, L. A., compilers (1955), *Oil and gas field atlas of the Butler quadrangle, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Special Bulletin 7, unpaginated.

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

QUADRANGLE LOCATION

SAXONBURG

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SLIPPERY ROCK QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Brookville coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43

Limits of strip mining based on field checking.

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — State Route

PENNSYLVANIA
QUADRANGLE LOCATION

SLIPPERY ROCK

CROP LINE AND MINED-OUT AREA OF THE BROOKVILLE COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line good to very good
Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43
Limits of strip mining based on interpretation of topographic map and on field checking.

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — State Route

PENNSYLVANIA
QUADRANGLE LOCATION

SLIPPERY ROCK

CROP LINE AND MINED-OUT AREAS OF THE
LOWER KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SLIPPERY ROCK QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p., and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from Gwin Engineers, Inc. (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 168 p.; and unpublished mine maps.

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — State Route

QUADRANGLE LOCATION

SLIPPERY ROCK

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Freeport coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Pott, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43.

UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:62 500

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — State Route

QUADRANGLE LOCATION

SLIPPERY ROCK

CROP LINE OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SLIPPERY ROCK QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

⬭ Horizon of the Upper Freeport coal

MAP RELIABILITY

Coal horizon—good to very good

SOURCES

Horizon based on interval projection by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43.

SLIPPERY ROCK

HORIZON OF THE
UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SLIPPERY ROCK QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

CROP LINES

lf — Lower Freeport coal

uk — Upper Kittanning coal

mk — Middle Kittanning coal

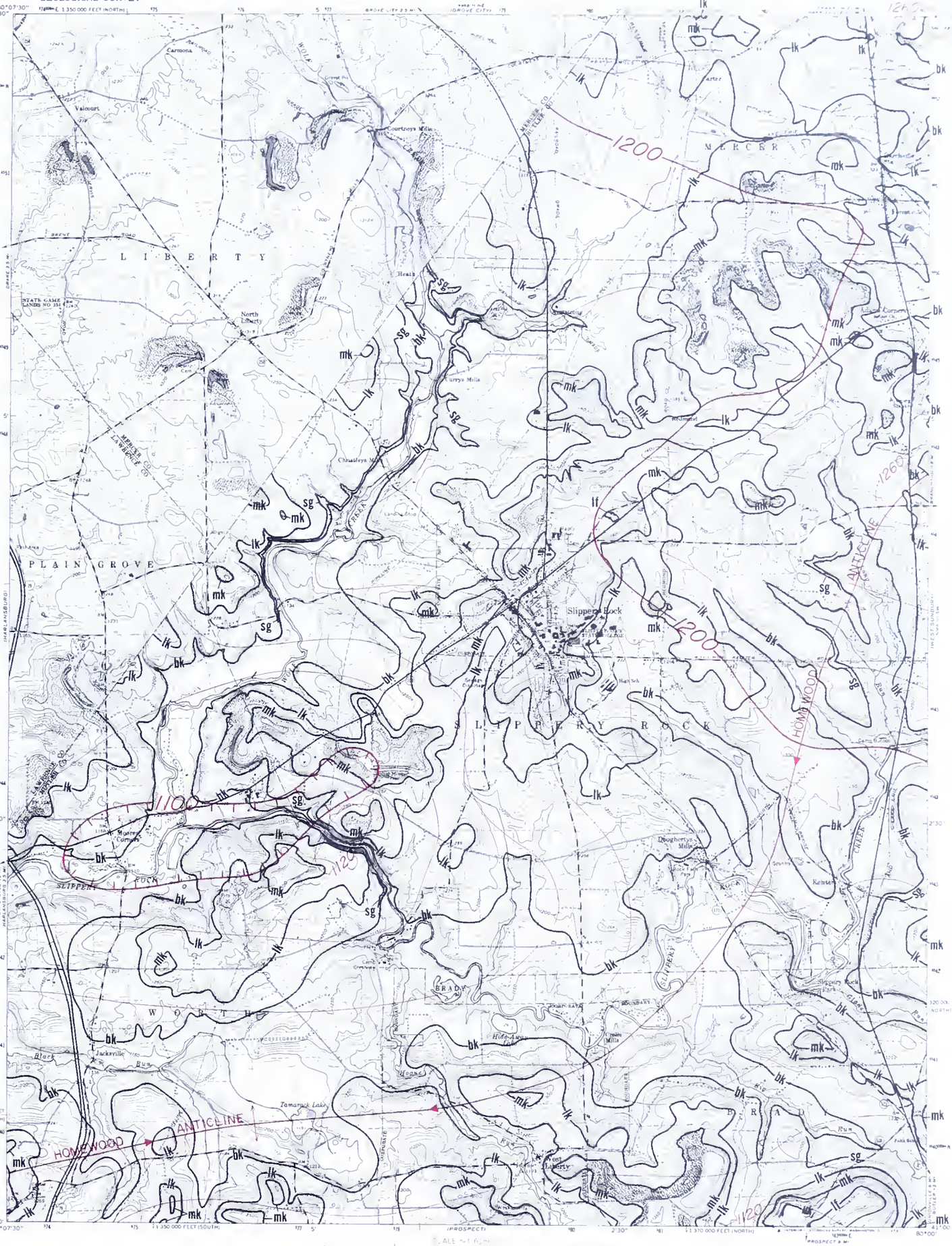
lk — Lower Kittanning coal

sg — Scrubgrass coal

bk — Brookville coal

Anticline
Showing axial-plane trace and direction of plunge

1200 — Structure contour
Altitude of the base of the Brookville coal, in feet above mean sea level. Contour interval 20 feet



MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Poth, C. W. (1963), *Geology and hydrology of the Mercer quadrangle, Mercer, Lawrence, and Butler Counties, Pennsylvania*, Pennsylvania Geological Survey, 4th ser., Water Resource Report 16, 149 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43. Structure contours extensively modified by C. H. Dodge from Poth (1963)

SCALE 1:15 840

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1971 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
Interstate Route — State Route

QUADRANGLE LOCATION

SLIPPERY ROCK

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Upper Freeport coal

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; minor reference to Richardson, G. B. (1932), *Geology and coal, oil, and gas resources of the New Kensington quadrangle, Pennsylvania*, U.S. Geological Survey Bulletin 829, 102 p.
Limits of deep mining from unpublished mine maps.

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

Heavy duty — Light duty
Medium duty — Unimproved dirt
U.S. Route — State Route
Interstate Route

QUADRANGLE LOCATION

VALENCIA

CROP LINE AND MINED-OUT AREAS OF THE

UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—— du ——
Duquesne coal

—— hm ——
Harlem coal

—— ub ——
Upper Bakerstown coal

—— mh ——
Mahoning coal

—— uf ——
Upper Freeport coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge.

900
Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43, minor reference to Richardson, G. B. (1932), *Geology and coal, oil, and gas resources of the New Kensington quadrangle, Pennsylvania*, U.S. Geological Survey Bulletin 829, 102 p.
Structure contours modified by C. H. Dodge from Richardson (1932).

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

ROAD CLASSIFICATION

VALENCIA

COAL CROP LINES AND STRUCTURE CONTOURS

EXPLANATION

Crop line of the Brookville coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SCALE ≈1:62500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

State Route

PENNSYLVANIA
QUADRANGLE LOCATION

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43

Limits of strip mining based on interpretation of topographic map and on field checking

Limits of deep mining from Gwin Engineers, Inc. (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 16B p.; and unpublished mine maps.

WEST SUNBURY

CROP LINE AND MINED-OUT AREAS OF THE BROOKVILLE COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WEST SUNBURY QUADRANGLE
PENNSYLVANIA-BUTLER CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Lower Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line – good to very good

Limits of known strip mining – approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43

Limits of strip mining based on interpretation of topographic map and on field checking

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:62 500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

QUADRANGLE LOCATION

ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

State Route

WEST SUNBURY

CROP LINE AND MINED-OUT AREAS OF THE LOWER KITTANNING COAL

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from Gwin Engineers, Inc. (1970), *Slippery Rock Creek mine drainage pollution abatement project*, Pennsylvania Department of Mines and Mineral Industries, Operation Scarlift Project SL 110, 168 p.; and unpublished mine maps.

UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

State Route

PENNSYLVANIA

QUADRANGLE LOCATION

WEST SUNBURY

CROP LINE AND MINED-OUT AREAS OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43.
Limits of strip mining based on interpretation of topographic map and on field checking

UTM GRID AND 1975 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
State Route

QUADRANGLE LOCATION

WEST SUNBURY

CROP LINE AND MINED-OUT AREAS OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WEST SUNBURY QUADRANGLE
PENNSYLVANIA
7.5 MINUTE SERIES (TOPOGRAPHIC)

EXPLANATION

Crop line of the Upper Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1-C43.

Limits of strip mining based on interpretation of topographic map and on field checking

UTM GRID AND 1978 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
State Route

PENNSYLVANIA
QUADRANGLE LOCATION

WEST SUNBURY

CROP LINE AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

—uf—
Upper Freeport coal

—lf—
Lower Freeport coal

—uk—
Upper Kittanning coal

—mk—
Middle Kittanning coal

—lk—
Lower Kittanning coal

—sg—
Scrubgrass coal

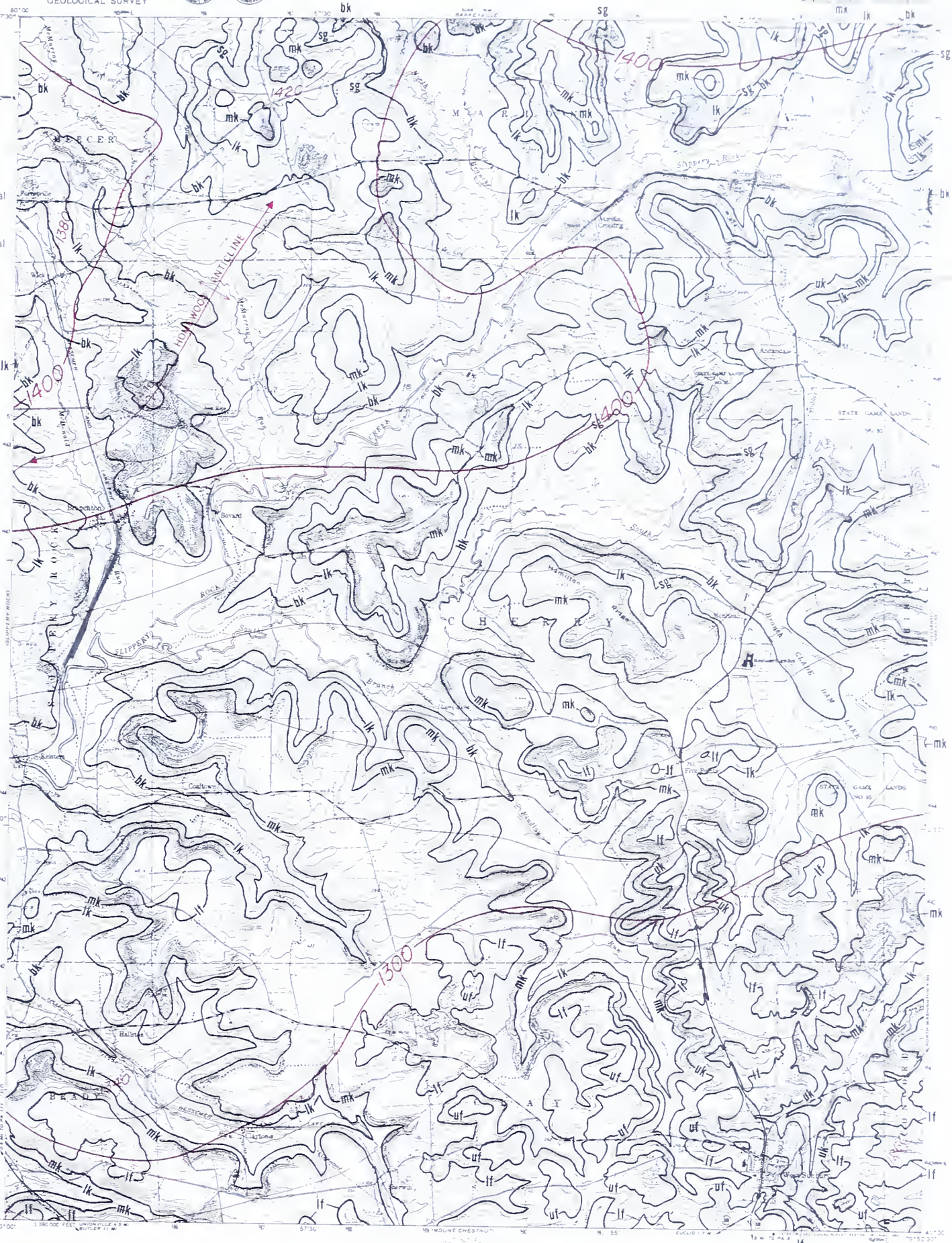
—bk—
Brookville coal

Anticline
Showing axial plane trace and direction of plunge

—1300—
Structure contour
Altitude of the base of the Middle Kittanning coal, in feet above mean sea level. Contour interval 20 feet

MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good



CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

SOURCES

Crop lines modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.

Structure contours extensively modified by C. H. Dodge from Sherrill, R. E., and Matteson, L. S. (1939), *Geology of the oil and gas fields of the Hilliards quadrangle*, Pennsylvania Geological Survey, 4th ser., Progress Report 122, 25 p.

WEST SUNBURY

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Brookville coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43. Limits of strip mining based on interpretation of topographic map and on field checking.

WORTHINGTON

CROP LINE AND MINED-OUT AREAS OF THE BROOKVILLE COAL

EXPLANATION

Crop line of the Lower Kittanning coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Butts, Charles, and Leverett, Frank (1904) *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

WORTHINGTON

CROP LINE OF THE LOWER KITTANNING COAL

EXPLANATION

Crop line of the Middle Kittanning coal

MAP RELIABILITY

Coal crop line—good to very good

SOURCES

Crop line modified by C. H. Dodge from Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43.

SCALE IN FEET

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

JTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

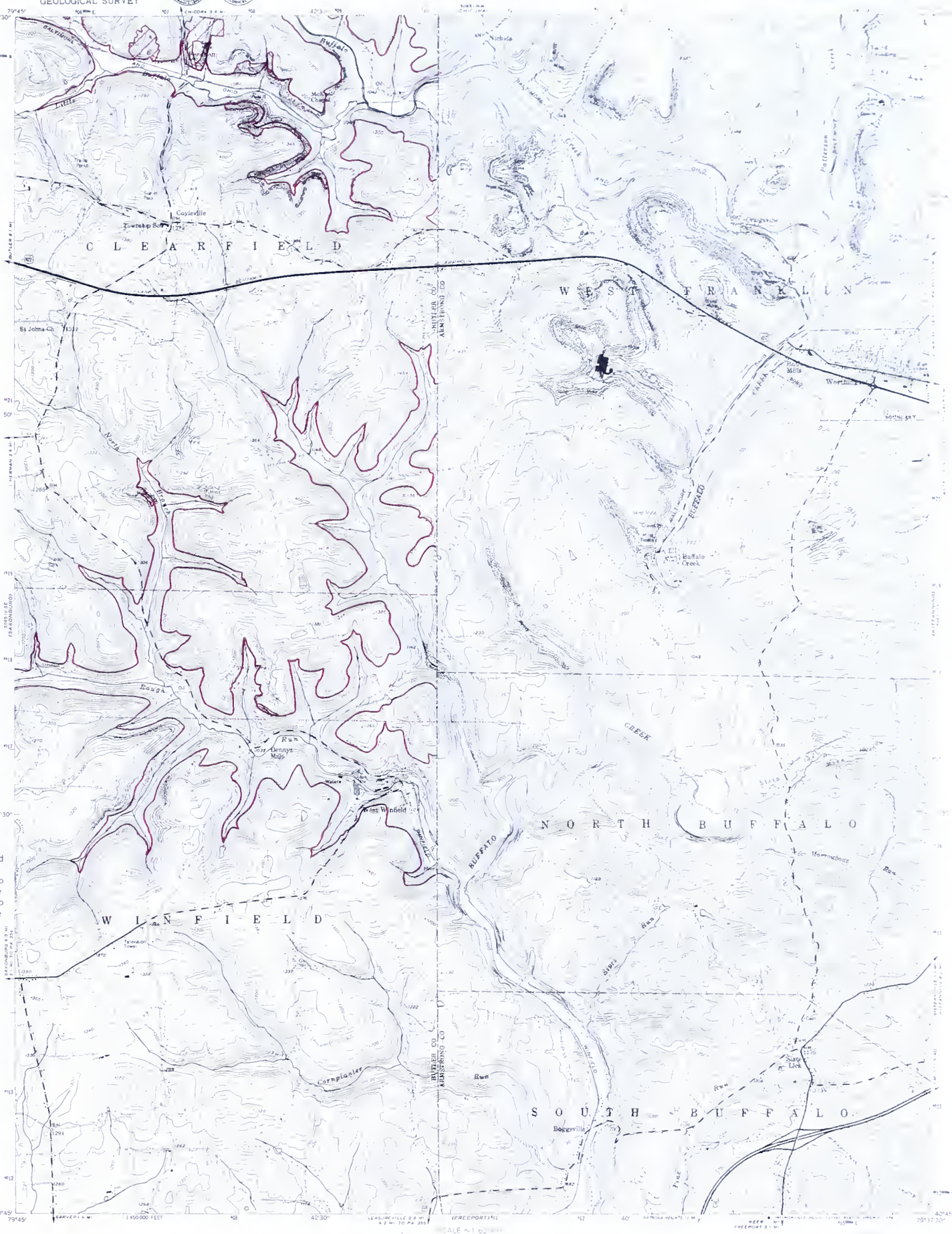
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

PENNSYLVANIA
QUADRANGLE LOCATION

WORTHINGTON

CROP LINE OF THE MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY



EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate

SOURCES

Crop line modified by C. H. Dodge from Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.

Limits of strip mining based on interpretation of topographic map and on field checking

Limits of deep mining from unpublished mine maps

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ROAD CLASSIFICATION

Heavy-duty — Light-duty

Medium-duty — Unimproved dirt

U. S. Route — State Route

QUADRANGLE LOCATION

WORTHINGTON

CROP LINE AND MINED-OUT AREAS OF THE LOWER FREEPORT COAL

EXPLANATION

Crop line of the Upper Freeport coal

Extent of known strip mining

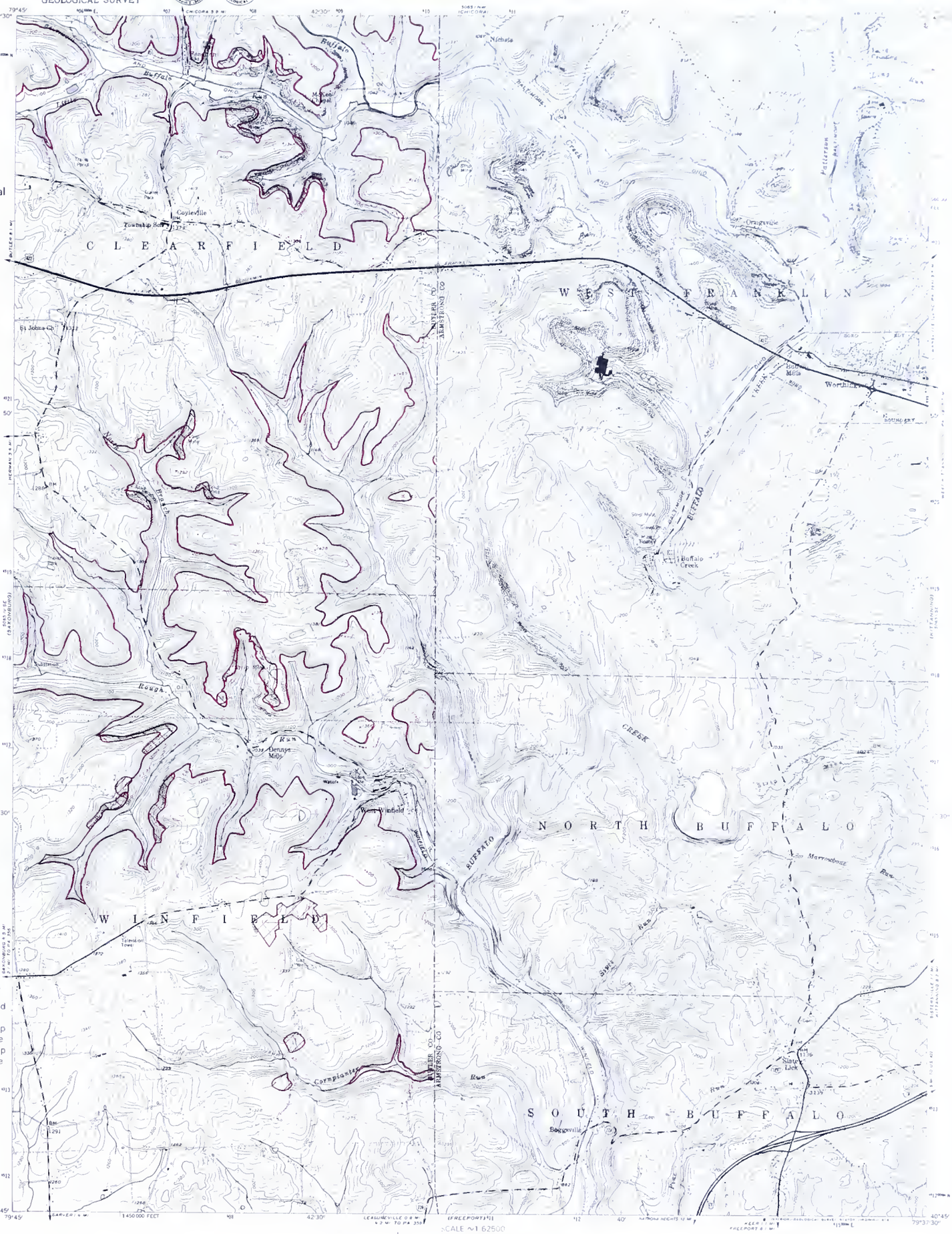
Extent of known deep mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

Limits of known deep mining—approximate



SOURCES

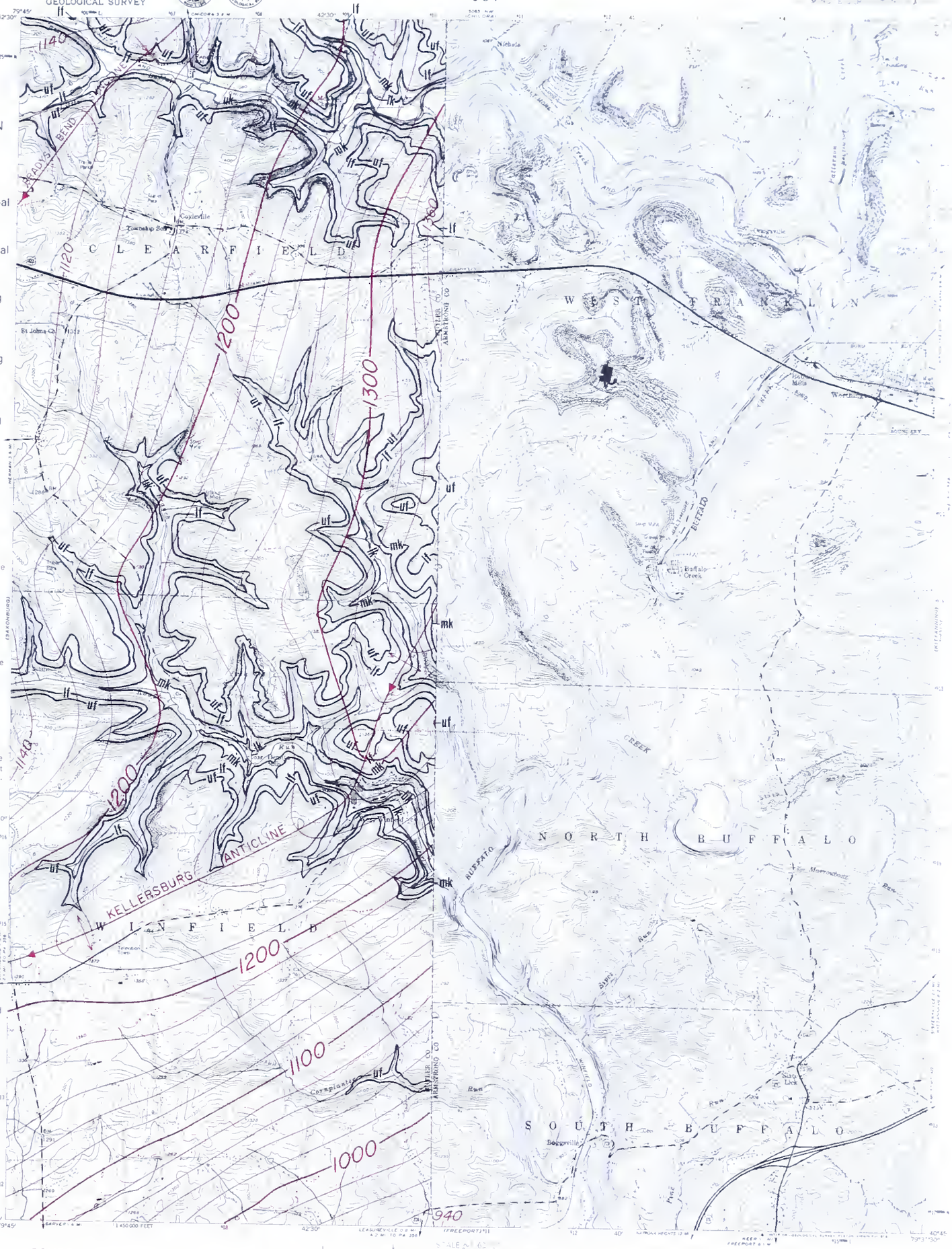
Crop line modified by C. H. Dodge from Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43.

Limits of strip mining based on interpretation of topographic map and on field checking.

Limits of deep mining from John T. Boyd Company (1968), *Revised reserve alternatives—Case 1 and case 2, Hannahstown coal field, Butler County, Pennsylvania—For Bessemer and Lake Erie Railroad Company*, unpublished report, unpaginated; and unpublished mine maps.

WORTHINGTON

CROP LINE AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL



EXPLANATION

CROP LINES

—uf— Upper Freeport coal

—lf— Lower Freeport coal

—uk— Upper Kittanning coal

—mk— Middle Kittanning coal

—lk— Lower Kittanning coal

—bk— Brookville coal

Anticline
Showing axial-plane trace and direction of plunge.

Syncline
Showing axial-plane trace and direction of plunge

—1200— Structure contour
Altitude of the base of the Upper Freeport coal, in feet above mean sea level. Contour interval 20 feet

MAP RELIABILITY

Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines modified by C. H. Dodge from Butts, Charles, and Leverett, Frank (1904), *Kittanning folio, Pennsylvania*, U.S. Geological Survey Geologic Atlas of the U.S., Folio 115, 15 p.; and Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43

Structure contours extensively modified by C. H. Dodge from Butts and Leverett (1904).

SCALE 1:62 500

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1979 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

QUADRANGLE LOCATION

WORTHINGTON

COAL CROP LINES AND STRUCTURE CONTOURS

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ZELIENOPLE QUADRANGLE
PENNSYLVANIA

EXPLANATION

Extent of known strip mining

MAP RELIABILITY

Limits of known strip mining approximate

SOURCES

Limits of strip mining based on interpretation of topographic map and on field checking.

SCALE 1:25000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route
Interstate Route

ZELIENOPLE

MINED-OUT AREA OF THE
STRASBURG COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Middle Kittanning coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line extensively modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking

ZELIENOPLE

CROP LINE AND MINED-OUT AREA OF THE

MIDDLE KITTANNING COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

Crop line of the Lower Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line extensively modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin B73, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

SCALE ~1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1969 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION

Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route

QUADRANGLE LOCATION

ZELIENOPLE

CROP LINE AND MINED-OUT AREA OF THE LOWER FREEPORT COAL

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

ZELIENOPLE 7.5' QUADRANGLE
PENNSYLVANIA

EXPLANATION

Crop line of the Upper Freeport coal

Horizon of the Upper Freeport coal

Extent of known strip mining

MAP RELIABILITY

Coal crop line and horizon—good to very good

Limits of known strip mining—approximate

SOURCES

Crop line extensively modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143-C, p. C1–C43, some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.

Limits of strip mining based on interpretation of topographic map and on field checking.

CROP LINE, HORIZON, AND MINED-OUT AREAS OF THE UPPER FREEPORT COAL

ZELIENOPLE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

EXPLANATION

CROP LINES

wi — Wilgus coal

mh — Mahoning coal

uf — Upper Freeport coal

lf — Lower Freeport coal

uk — Upper Kittanning coal

mk — Middle Kittanning coal

900 — Structure contour
Altitude of the base of the Middle Kittanning coal, in feet above mean sea level. Contour interval 20 feet.

MAP RELIABILITY
Coal crop lines—good to very good
Structure contours—good to very good

SOURCES

Crop lines extensively modified by C. H. Dodge from Patterson, E. D., and Van Lieu, J. A. (1971), *Coal resources of Butler County, Pennsylvania*, U.S. Geological Survey Bulletin 1143–C, p. C1–C43; some reference to Richardson, G. B. (1936), *Geology and mineral resources of the Butler and Zelienople quadrangles, Pennsylvania*, U.S. Geological Survey Bulletin 873, 93 p.
Structure contours compiled by C. H. Dodge from unpublished data; some reference to Richardson (1936).

SCALE 1:62500

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

ROAD CLASSIFICATION
Heavy-duty — Light-duty
Medium-duty — Unimproved dirt
U.S. Route — State Route
Interstate Route

QUADRANGLE LOCATION

ZELIENOPLE

COAL CROP LINES AND STRUCTURE CONTOURS